

TASKS REALISATION BY PARTNERS

Work Package Task number	Work Packages and Tasks titles	Partners
Work Package 1	Investigation of drying efficiency on paper and pressboard samples	Leader PUT
Task 1.1.	Kick-off meeting	ALL
Task 1.2.	Choosing of samples, ageing procedures and measuring techniques for evaluation of main quantities describing investigated insulation systems	PUT
Task 1.3.	Assessment of physical, mechanical and electrical property changes in the dependence of drying process parameters of samples with various degree of degradation	PUT+IEN; CHALMERS
Task 1.4.	Assessment of recommended residual water content in cellulose insulation on the basis of two criteria – mechanical strength and dielectric parameters	PUT+IEN
Task 1.5.	Assessment of drying process efficiency in dependence of the degree of cellulose degradation – the influence of the kind of physical bonding on the process of water release	PUT+IEN; USTUTT
Task 1.6.	Determination of the limit value of the degree of polymerisation (DP) of cellulose, below which the drying process is not advisable for the sake of critical deterioration of mechanical properties	PUT+USTUTT+IEN
Work Package 2	Investigations carried-out on simple laboratory models	Leader USTUTT
Task 2.1.	Determination of the relationship between heating current frequency, voltage ratio and thermal effect in primary and secondary winding in model of one-phase transformer	USTUTT+AREVA; IEN
Task 2.2.	Investigation of the dynamics of pressboard barrier drying in vacuum, heated indirectly by the winding insulated with paper	USTUTT+AREVA; PUT
Task 2.3.	Comparison of the degree of pressboard drying rate obtained with the vacuum monitoring method and the direct method based on Karl-Fischer measurements	IEN+PUT;
Task 2.4.	Measurement methodology of winding average temperature at low frequency and comparison of the results with those obtained at DC	IEN
Task 2.5.	Comparison of the winding hot spot temperature during heating with the average temperature obtained on the basis of winding resistance measurement	IEN
Task 2.6.	Symposium – the exchange of experiences	USTUTT+ALL
Work Package 3	Investigations of phenomena related to drying process carried-out in laboratory on models and transformers	Leader USTUTT
Task 3.1.	Computer simulation of temperature distribution for some chosen transformer designs	USTUTT
Task 3.2.	Computer simulation of water migration in dependence of temperature gradient and residual gas pressure gradient	CHALMERS
Task 3.3.	Calculation of optimal heating current frequency in the aspect of thermal effect	IEN+USTUTT
Task 3.4.	Design and manufacturing of the models of transformer for investigation of drying efficiency with the use of low frequency heating current – temperature sensors positioning	USTUTT+AREVA; CZERWONAK+PUT+IEN
Task 3.5.	Investigation of temperature gradients in cellulose insulation regarding to chosen parameters of drying procedure	USTUTT; PUT+CZERWONAK+IEN
Task 3.6.	Investigation of clamping force after drying of aged insulation	CZERWONAK+PUT+IEN
Task 3.7.	Pre-drying and impregnation procedures (washing of insulation, oil treatment)	IEN
Task 3.8.	Optimisation of the relation: temperature-vacuum-time in the technically-economic aspect	IEN+PUT+CZERWONAK
Task 3.9.	Symposium via Internet	ALL
Work Package 4	Design and manufacturing of mobile system for “on-site” drying	Leader IEN
Task 4.1.	System design	IEN
Task 4.2.	Devices purchasing	CZERWONAK+IEN
Task 4.3.	Manufacturing of the power supply and control system (container K1)	CZERWONAK+IEN
Task 4.4.	Completing of pumps, devices for vacuum system and auxiliary equipment; manufacturing of container K2	CZERWONAK+IEN
Task 4.5.	Completing of devices for oil treatment; manufacturing of container K3	CZERWONAK+IEN
Task 4.6.	Completing of devices for diagnostics system; manufacturing of container K4	CZERWONAK+IEN
Task 4.7.	Manufacturing of the oil tank	CZERWONAK
Task 4.8.	Assembling of the mobile system and final technological tests	CZERWONAK+IEN
Work Package 5	Investigation of the drying process in laboratory using the mobile system	Leader PUT
Task 5.1.	Assessment of the possibilities of water content determination in the cellulose insulation in vacuum in time of drying process, using the dielectric response methods	CZERWONAK+PUT+IEN
Task 5.2.	Tests of the mobile system on model transformer with temperature sensors; assessment of moisture content using FDS (Frequency Domain Spectroscopy), RVM (Recovery Voltage Measurement) and bridge method	CZERWONAK+PUT+IEN

Task 5.3.	Tests of the mobile system on real high voltage power transformer in laboratory; assessment of moisture content using FDS, RVM and bridge method	CZERWONAK+PUT+IEN
Work Package 6	Drying of power transformers in substation using the mobile system	Leader CZERWONAK
Task 6.1.	Choosing the transformers that require drying	CZERWONAK+PUT; USTUTT+AREVA
Task 6.2.	Investigations carried-out on transformer on-site for verification of the relation of temperature-vacuum-time	PUT+IEN+CZERWONAK; USTUTT+AREVA
Task 6.3.	Determination of the required time of drying procedure for chosen transformer types	PUT+IEN+CZERWONAK; USTUTT+AREVA
Work Package 7	Strategy of the management of power transformers in the aspect of technical-economical effectiveness of drying process	Leader DELFT
Task 7.1.	Development and implementation of a data-base tool to collect and to analyse the asset information (transformer- and condition data); development of statistical tools to generate decision norms for technical status of a particular transformer	DELFT
Task 7.2.	Development of decision support model to analyse the technical status and to combine this information with economic aspects (operation- and AM approach) to trigger the most optimal maintenance activities	DELFT
Work Package 8	Management	Leader PUT
Task 8.1.	Steering Committee (SC) meetings	ALL
Task 8.2.	Periodic reports	PUT compiles ALL involved
Task 8.3.	Day-to-day communication and management	ALL
Task 8.4.	Mid-term and final review (24 th , 42 nd month)	PUT compiles ALL involved
Work Package 9	Dissemination	Leader CHALMERS
Task 9.1.	Preparation of the Internet www page about the Project and its periodic update	ALL
Task 9.2.	Work in the scope of standardisation	ALL
Task 9.3.	Utilisation of the Project experience	ALL
Task 9.4.	Commercial utilisation of the mobile drying system and clamping force measuring system – preparation of the commercial offer	ALL
Work Package 10	Development and manufacturing of a direct measuring system for axial clamping forces in transformers	Leader ICMET
Task 10.1	Technical specification	ICMET
Task 10.2	Specification discussion and acceptance	ALL
Task 10.3	Design of measuring system	ICMET
Task 10.4	Components purchasing	ICMET
Task 10.5	Realisation of prototype	ICMET
Task 10.6	Testing in laboratory (short and long time tests)	ICMET
Task 10.7	Improvement/completion of measuring system	ICMET
Task 10.8	Practical use (mounting) on a refurbished transformer	CZERWONAK+PUT+IEN; USTUTT
Task 10.9	Investigation of clamping forces in / after drying process (influence of materials quality and ageing, oil moisture, temperature, a.s.o)	ALL
Task 10.10	Virtual symposium on internet	ALL