



Annex “Specifications”

	Nordisk Sikkerhet AS
	Tender title: Supply of control and measurement instruments: X-Ray Diffractometer
	Project title: “Control and measurement instruments for State Regulatory Authority of Tajikistan (stage 2)”

Specifications

Supply of control and measuring instruments:
X-Ray Diffractometer

Contracting Authority: Nordisk Sikkerhet AS
Recipient: Nuclear and Radiation Safety Agency of Tajikistan
Tenderer’s name: _____

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NOTE

The Tenderer shall fill in the Annex “Specifications” in the format given below. The Tenderer’s proposed supplies should be manufactured and certified in accordance with the technical regulations and standards of Tajikistan and/or the country of origin. The complete table should be submitted to the Contracting Authority along with the required tender documents. On the front page of the Annex “Specifications”, the Tenderer shall indicate its name. After the completion of this document, it should be signed and dated by the Tenderer-authorized person.

1. X-RAY DIFFRACTOMETER

	Contracting Authority’s Requirements	Tenderer’s Offer
Manufacturer	—	
Model	—	
Scope of supply	1 complex	
TECHNICAL SPECIFICATIONS		
Type	X-ray diffractometer based on high-precision wide-angle 2θ (theta) goniometer with variable radius	
Functions	X-ray diffraction analysis of phase composition, structural state and orientation of a wide range of objects with various shape and size	
Equipment	<p>The X-Ray Diffractometer shall be equipped with the following (or equivalent):</p> <ul style="list-style-type: none"> - X-ray Diffractometer including: <ul style="list-style-type: none"> (i) Vertical double circular goniometer, (ii) X-ray tube with program-controlled electromagnetic shutter; (iii) X-ray tube cooling system, (iv) Rotating powder sample holder, (v) X-ray collimation system with a set of changeable slits (vi) β-filter, (vii) Protective cabinet; - Unit for installing two detectors (scintillation and position-sensitive detectors); - Scintillation detection unit NaI (Tl), 	

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	<ul style="list-style-type: none"> - Linear stripped position-sensitive detector (equipped with a holder, slit system and primary beam trap); - Unit for measurements on reflection/transparency of various types of samples; - High-temperature chamber with rotating sample holder (up to 1200 °C or higher); - Low- temperature and moisture chamber (up to minus 180 °C or lower); - Reference sample (polycrystalline quartz or equivalent); - Set of additional holders/cuvettes: <ul style="list-style-type: none"> (i) Silicon monocrystalline holder for studying trace amounts of matter, (ii) Silicon monocrystalline cuvette for calibration against the reference, (iii) Cuvette for bulk samples (with variable depth), - Personal computer (with pre-installed software), - Specialized software for data treatment and analysis - Spare parts and accessories. 	
Type of samples	<ul style="list-style-type: none"> - Dispersed materials and powders (natural and synthetic ones), - Monolithic polycrystalline samples (ceramics, details, structures, rocks, etc.) 	
PERFORMANCE		
Goniometer		
Geometry	<p>The X-Ray Diffractometer shall support the following geometries:</p> <ul style="list-style-type: none"> - Bragg-Brentano geometry, - Parallel-beam geometry. <p>Fast change of the geometries</p>	
Angular range, deg.	<ul style="list-style-type: none"> - 2θ: From minus 10 to 165 - θD (angle of detector rotation): From minus 5 to 165 - θF (angle of X-ray tube rotation): From minus 5 to 95 	
Automatic alignment of sample plane	Yes	

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Programmable scanning modes	Yes, both discreet and continuous	
Available scanning techniques	(i) $\theta - \theta$ (ii) θ (iii) Ω (iv) $2\theta - \Omega$ (v) Ψ	
Minimum scanning step, no more than	0.0005 deg.	
Scanning speed	From 0.1 to 100 deg./min or better	
X-RAY TUBE		
Material of X-ray tube anode	Copper	
Cooling of X-ray tube	Yes, water cooling	
Focus of X-ray tube	10x1.6 mm ² or better	
X-RAY TUBE COOLING SYSTEM		
Cooling of detector	Yes. Autonomous refrigerator-type cooling system. Cooling of the X-ray tube with water in a closed circuit	
Connection to water supply system	No, not required	
Connection to sewage system	No, not required	
DETECTORS		
1st DETECTOR		
Type of first detector	Scintillation detector, NaI (TI) or equivalent	
Maximum count rate, no less than	1 x 10 ⁶ imp/sec	
2nd DETECTOR		
Type of second detector	Linear stripped (position-sensitive) detector, silicon diode line or equivalent	
Active area dimensions, no less than	8 x 32 mm ²	
Registration efficiency for line of 8 keV, no less than	96%	
Energy range	From 4 to 40 keV or better	
Number of channels, no less than	640	
Maximum count rate per channel, no less than	1 x 10 ⁶ imp/sec	
Cooling	Electrical air cooling (fan) with noise-free performance	

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HIGH-TEMPERATURE CHAMBER		
Purpose	Studies of phase transformations, chemical reactions, as well as analysis of thermal deformation of the crystal lattice in the course of heating	
Temperature range	From 25 to 1200 °C or better	
Angular range for 2θ scanning	From 0 to 164° or better	
Ambiance	- Vacuum, - Air, inert gas.	
LOW-TEMPERATURE AND MOISTURE CHAMBER		
Purpose	Studies of phase transformations, chemical reactions, as well as analysis of measurements of structural state depending on temperature and/or humidity	
Working temperatures	For cooling by compressed air: - Vacuum: up to minus 5°C, - Air, inert gas: up to minus 5°C, - Wet gas: up to plus 10°C For cooling by liquid nitrogen: - Vacuum: up to minus 180°C, - Air, dry nitrogen: up to minus 120°C or better	
Humidity range	- From 5 to 95% at ambient temperature of 10 to 60 °C; - From 5 to 70% at ambient temperature of 80 °C or better	
Angular range for 2θ scanning	From 0 to 164° or better	
PERSONAL COMPUTER		
Personal computer (PC)	On the base of PC having the following or better characteristics: - Intel Core i5; - RAM 4096 MB; - HDD 500 GB; - LCD monitor 24" or greater;	

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	<ul style="list-style-type: none"> - External connections: COM-port, Ethernet ≥ 2; - Wireless keyboards; - Wireless mouse. 	
Application software functions	<ul style="list-style-type: none"> - Control and diagnostics of the Diffractometer and its units; - Automated measurements of the diffraction spectrum in a given angular range with a given exposure (or scanning speed) for θ-θ, θ, Ω, 2θ-Ω, Ψ-scanning in continuous/stepped scanning mode; - Measurements with multiple scanning of various angular intervals with subsequent averaging or summing of results; - Storage of measurement data in the form of data files of various formats; - Diffraction data treatment and analysis. 	
User’s interface	In Russian or Tajik language	
System software	Yes, installed on PC, including Windows 7/8/10 (32 or 64 bit)	
Application software	Yes, installed on PC	
Software licenses	Both for system and application software, for 5 years of operation	
Diffraction data treatment and analysis	<ul style="list-style-type: none"> - Processing the diffraction pattern or its fragment, including: <ul style="list-style-type: none"> (i) Background approximation (polynomial or custom curve); (ii) Separation of $K\alpha$ doublets; (iii) Calculations of the angular positions of maxima; (iv) Approximation of reflex profiles by pseudo-Voigt function; (v) Calculation of linear and integrated reflex intensities; 	

	<ul style="list-style-type: none"> (vi) Calculation of FWHM reflexes; (vii) Calculation of the amorphous phase content (degree of crystallinity); (viii) Calculation of mass absorption coefficients for any chemical compounds; <p>- Quantitative phase analysis of a mixture by seven methods including:</p> <ul style="list-style-type: none"> (ix) Complete analysis of a multiphase mixture; (x) Analysis of an n-component system; (xi) Analysis of a sample with a known mass absorption coefficient; (xii) Method of internal standard; (xiii) Method of corundum numbers; (xiv) Method of additives; (xv) Dilution method; <p>- Calculation of areas of coherent scattering and microstrains;</p> <p>- Calculation of unit cell parameters (UCP) for various components in multiphase systems;</p> <p>- Rietveld method of data processing;</p> <p>- Calculation of theoretical diffraction pattern;</p> <p>- Qualitative analysis using the Powder Diffraction Database PDF-2/PDF-4, made by the International Center for Diffraction Data (ICDD).</p>	
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OTHER REQUIREMENTS		
Physical dimensions, no more than	1500x1500x2400 mm (length x width x height)	
Weight, no more than	1000 kg	
Power supply	From mains of AC current, 220 ±10% V, 50±5 Hz	
Mean time between failures, no less than	10 000 hours	
Service life, no less than	10 years	
ENVIRONMENTAL REQUIREMENTS TO OPERATION		
Ambient temperatures	From +15 to +35 °C	
Relative humidity	Up to 80% at ambient temperature of 25°C and lower, without condensation of moisture	
PRESERVATION AND PACKAGING		
Packaging	Protection for transportation, handling and reliable storage without re-preservation within 1 year upon delivery.	
Physical dimensions of packaging, no more than	900x2000 mm (the entrance to the place of operation is limited by the door of 900x2000 mm. If required, the doorway may be extended to 1300 x2000 mm)	
OTHER REQUIREMENTS		
Certification	Yes, the X-Ray Diffractometer shall be certified for use in Tajikistan or in the country of origin	
Dual-use items (goods, software or technologies)	Not accepted. The X-Ray Diffractometer shall not be subject to export control, shall not contain dual-use goods, software or technologies and must not be under export/import restrictions of a similar nature.	
Visibility of Norwegian financing	Any equipment delivered under the contract should be clearly identified and should have metallic plates or indelible labels containing the flag of Norway and the phrase “Provided with support from the Government of Norway” in Tajik/Russian and in English.	

2. DOCUMENTATION

	Contracting Authority's Requirements	Tenderer's Offer
DOCUMENTATION		
Technical specifications/ conditions	Russian	
Passport/logbook	Russian	
User's manual, including measurement techniques and guidelines on the application of specialized software	Russian	
Documents attesting certification of X-ray Diffractometer in Tajikistan or in the country of origin	Russian or English	
Certificate of primary metrological verification from Tajikistan or the country of origin	Russian or English	
Software licenses	Russian or English	
Training documentation	Russian	
Transportation documentation	Russian and English	

3. DELIVERY TERMS AND CONDITIONS

	Contracting Authority's Requirements	Tenderer's Offer
DELIVERY TERMS AND CONDITIONS		
Terms of Delivery	DDP, Incoterms 2010	
Place of Delivery and Installation	299/2 Ayni st., 734000, Dushanbe, Tajikistan Technical Support organization of Nuclear and Radiation Safety Agency	
Delivery Time	≤ 180 calendar days after the date of contract signature	

4. TRAINING COURSE: OPERATION, MAINTENANCE AND REPAIR

	Contracting Authority's Requirements	Tenderer's Offer
TRAINING		
TRAINING COURSE		
Place of training (training room to be provided by the Recipient)	299/2 Ayni st., 734000, Dushanbe, Tajikistan Technical Support organization of Nuclear and Radiation Safety Agency	
Duration of training course	2 days	

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Language of training course	Tajik/Russian	
Number of trainees, up to	6 persons	
Themes to be covered	- Operating principles, - Use and operation, - Measurement techniques, - Maintenance and metrological verification, - Minor repairs.	
Theoretical part duration, no less than	1/2 day	
Practical part duration, no less than	1 and 1/2 day	
Instructional video	Optional	
Verification	Test, written form	
TRAINING COURSE DOCUMENTATION		
One certificate per trainee	In Tajik /Russian and English	
List of materials to provide per trainee	- Set of training materials; - User’s documentation; - Training materials on one CD/DVD.	
Results of test after training should be delivered to the Contracting Authority and Recipient	Yes	

5. WARRANTY AND POST-WARRANTY SERVICES

	Contracting Authority’s Requirements	Tenderer’s Offer
WARRANTY AND POST-WARRANTY SERVICES		
Duration of warranty period	≥ 24 months	
Place of warranty repairs and maintenance	Tajikistan	
Presence of official representative of the manufacturer or authorised service centre in the FSU region	Yes	
Technical support during warranty and post-warranty period	Technical support by email or telephone in Tajik /Russian/English to solve any technical problems (software failure, anomalous behavior, minor improvements concerning process, functional capabilities of data processing, etc.) and rectify any system-disabled state	
After-sales service	Compulsory after-sales service to be provided under a separate agreement with the Recipient shall include the following: - Maintenance and post warranty repair of the	

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	equipment on the territory of Tajikistan; - Rapid provision of spare parts and consumables.	
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6. TIME SCHEDULE

No.	Action	Period of completion	Tenderer's Offer
1.	Submission of documents: - Passport/logbook, - User's manual, including measurement techniques and guidelines on the application of specialized software, - Documents attesting certification of X-ray Diffractometer in Tajikistan or the country of origin, - Certificate of primary metrological verification from Tajikistan or the country of origin, - Software licenses, - Transportation documentation.	2 weeks before the scheduled shipment and supplied with equipment	
2.	Submission of documents: - Training programme, - Training course documentation.	3 weeks before the scheduled training	
3.	Submission of documents: - Programme and procedure of on-site acceptance tests.	3 weeks before the scheduled on-site acceptance tests	
4.	Delivery	Within 180 calendar days after the signing of Contract	
5.	Installation (assembling, mounting, starting-up and adjustment)	Within 200* calendar days after the signing of Contract	
6.	Training of personnel	Within 200* calendar days after the signing of Contract	

Note: *) The personnel training must be carried out not later than 20* calendar days after the delivery of equipment. The actual dates of training shall be confirmed by the Recipient and Contracting Authority no later than 10 days before the training course.

Authorized person on behalf of the Tenderer:

Name: _____

Title: _____

Signature: _____

Date: _____