SYSTEM REQUIREMENTS

FOR

TRANSMISSION SYSTEM

170/420 kV

Dynamic Cable Rating (DCR) System

NOGA	NAME	SIGNATURE	DATE
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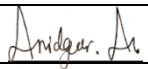
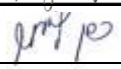
Checked by :	Adir Anidgar		02/01/2025
	Lior Cohen		02/01/2025
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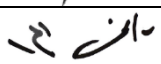
	Amir Yeger		02/01/2025

To be filled in by the client side:

DESCRIPTION	COMPANY NAME	CONTACT NAME	E- MAIL	DATE
Client (Purchaser) :				
Manufacturer :				

Manufacturer's factory address: _____

Number of units (Quantity): _____

Doc. revision: 1

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1. GENERAL

1.1. Location of Item: Measuring instrument with server software will be installed at the dedicated substations and client software will be installed at the IECo and Noga - Independed System Operator terminal personal computers.

1.2. Scope of Work: The system will be based on fiber optic Distributed Temperature Sensing (DTS) for monitoring the temperature of Transmission System (161,400 kV) underground cable power lines of the Israeli Transmission System. The DCR system should provide real-time dynamic rating calculation, excess of real-time capacity above static ratings, short time (up to 4 hours) and longtime (up to few days) ampacity forecasts for normal and emergency operating modes.

1.3. Project Description: DTS device will be used to monitor the temperature of Transmission System cables with an integrated fiber optic wire continuously along the specified circuits. The DCR system shall calculate conductor temperature from DTS temperature measurement and calculate real-time and forecast of ampacity based on international standards (clause 2).

1.4. This document can serve as a guide to those interested in carry out a detailed Specification for an appropriate DCR System that meets the Local Regulations and purchase requirements. This document focuses on the threshold requirements and should not be considered as a " DCR System Specification".

1.5. All subclauses in this system requirements for Transmission System for DCR System are compulsory requirements, the required ratings of the 170 kV DCR System shall be respectively at least of the values stated in chapter 3. Manufacturer's/Customer's proposal will be almost certainly disqualified, if its proposal does not meet with the "SYSTEM REQUIREMENTS" by NOGA'S demand.

2. APPLICABLE STANDARDS

2.1 Unless otherwise specified all equipment shall be designed, constructed and tested in accordance with the requirements of the latest relevant published Recommendations of the International Electrotechnical Commission (IEC) as amended up to date.

2.2 All aspects, tests, etc. not covered by IEC Recommendations, should be executed according to the latest published issue of official, or otherwise approved standards of Manufacturer’s country. In such cases, the standards themselves shall be supplied.

2.3 The terminology used in this SYSTEM REQUIREMENTS, except where otherwise indicated, in accordance with IEC Publications: Standards & Codes.

1. IEC 60853 series - Calculation of the cyclic and emergency current rating of cables.
2. IEC 60793 series - Establishes uniform requirements for measuring and testing optical fibres (typically within cable).
3. ITU Publication G.651.1 - Characteristics of a 50/125 µm multimode graded index optical fiber cable for the optical access network.
4. IEC 60529 - Degrees of protection provided by enclosures (IP code).
5. IEC 61180 (all parts) - High-voltage test techniques for low voltage equipment.
6. IEC 61000-6-2 - Electromagnetic compatibility (EMC) - Generic standards - Immunity standard for industrial environments.
7. EN61010-1 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.
8. IEC 61187: Electrical and electronic measuring equipment – Documentation.

3. TECHNICAL REQUIREMENTS AND REQUIRED INFORMATION

#	DESCRIPTION	REQUIRED VALUE /STANDARD	MANUFACTURER'S CONFIRMATION OR PROPOSAL
3.1	**SYSTEM DATA**	Grid Code	
3.1.1.	Rated system voltage (line to line)	161/400 (kV)	
3.1.2.	Highest system voltage (line to line)	170/420 (kV)	
3.1.3.	Neutral connection in the 170 kV systems	Effectively earthed	
3.1.4.	Earth fault factor	1.4	
3.1.5.	Frequency	50 (Hz)	
3.1.6.	Symmetrical short circuit current	50/63 (kA r.m.s)	
3.2	**ENVIRONMENTAL CONDITIONS**		
3.2.1	General:		
3.2.1.1	The supplier should declare and assure compliance acc. to relevant international standard of all parameters and their testing for the following conditions: Safety,Health, Enclosure, Package, Storage, Transportation	• IEC 60529 • IEC 61187 • IEC 60853 • IEC 61180 • IEC 61187 • EN 61010-1	
3.2.2	Environmental and Electromagnetic compatibility	IEC 61000-6-2	
3.2.2.1	The DTS Field Unit should be capable of working without compromising the accuracy and resolution specification in substation environments where switching transients and radio frequency (RF) interference are present		
3.2.2.2	The supplier should declare and assure compliance of all parameters and their testing acc. to relevant international standard requirements for: Environmental testing, Electromagnetic Compatibility (EMC) and Safety		
3.2.3	CLIMATIC CONDITIONS		
3.2.3.1	Permissible operating ambient air temperature:		
3.2.3.2	Minimum	-5 (˚C)	
3.2.3.3	Maximum	+40 (˚C)	

#	DESCRIPTION	REQUIRED VALUE /STANDARD	MANUFACTURER'S CONFIRMATION OR PROPOSAL
3.2.3.4	humidity:	85%	
3.3	**SERVICE CONDITIONS**		
3.3.1.	The Field Unit shall be indoor type		
3.3.2.	The DTS Field Unit shall be operable with a power supply (single-phase):	240 V ± 10% 50 Hz ± 5%	
3.4	**FUNCTIONAL REQUIREMENTS**		
3.4.1.	Field Unit temperature measurement capability	130 (˚C) on at least six channels over a minimum length of 10 km of the sensing fiber	
3.4.1.1.	Measurement modes	• Single-ended • Dual ended • Loop	
3.4.1.2.	Cables under test have two sets of embedded optical tubes	• 2 multimode fibers: 50/125 and 62.5/125 µm (core/cladding) • 1 single mode fiber 9/125 µm (core/cladding)	
3.4.2.	Optical fibers measurements		
3.4.2.1.	The measurements should be possible on each type of above mentioned optical fibers		
3.4.2.2.	These measuring distances shall be determined from the instrument to the remote end of the sensing fiber, which in the case of a closed-loop system will be near the instrument		
3.4.2.3.	The DTS unit shall be optimized for use with optical fiber cables meeting the requirements acc. to	• ITU G.651.1 • IEC 60793 series	
3.4.3.	Temperature and spatial resolution		
3.4.3.1.	Basic spatial resolution for measurement and basic temperature resolution, over the required power cable route length	0.5 (m) 0.5 (˚C)	

#	DESCRIPTION	REQUIRED VALUE /STANDARD	MANUFACTURER'S CONFIRMATION OR PROPOSAL
3.4.3.2.	The system accuracy and resolution shall not be compromised for at least	100 repeated connect and disconnect operations of the pigtail fibers for a specified optical attenuation variation of between 0.0 and 0.2 dB or as deemed appropriate by the manufacturer	
3.4.4.	The laser output of the Field Unit shall meet the requirements acc. to	Class 1M or Laser Safety requirements	
3.4.5.	Communication interfaces		
3.4.5.1.	The DTS Field Unit bulkhead connector shall be interchangeable to accommodate various types of connectors, such as FC, SC, E-2000, and ST.		
3.4.5.2.	The Field Unit should include: • Standard Ethernet 10/100/1000 base TX • USB • Serial RS232/485 • On boards storage type SSD • Cellular supporting		
3.4.6.	Field Unit web interface support		
3.4.6.1.	The Field Unit should support full featured HTTPS web interface		
3.4.6.2.	Allows monitoring all real-time information using internet browsers Microsoft Edge and Google Chrome		
3.4.6.3.	The web interface should provide full access to all device features, such as real-time monitoring, remote control and full device configuration		
3.4.7.	DATA ANALYSIS SOFTWARE		
3.4.7.1.	Report Compatibility: reports generated by the Base Station Analysis Software should be compatible with common PC software like Excel, PDF and suitable internet formats.		

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3.4.7.2.	User Management and Security: The Base Station software should include permits procedure by Username and Password intended to correctly distribute reports.		
3.4.7.3.	The following subset of software tools to be implemented as minimum:		
3.4.7.3.1.	Setup and firmware upgrades of Field Unit.		
3.4.7.3.2.	Automatic/periodic data retrieval from the Field Unit to the Base Station		
3.4.7.3.3.	Supplied software shall be a Microsoft Windows-based program with menu driven capabilities as well as graphical user interface (GUI) for facilitating the measurement setup (cable length, zones, trace ID, and alarms).		
3.4.7.3.4.	Generated data file structure format should be compatible with Microsoft Excel or Microsoft Access spreadsheet programs to allow for dynamic object linking with other Windows-based application programs.		
3.4.7.3.5.	Software shall permit easy user-labeling of zones (distance and mean, high or low temperatures in the zones), hot spot locations, trace annotations, and features alarms for each measurement.		
3.4.7.3.6.	Software shall have an Auto-Save feature that allows user-controlled, time driven closing of data files as well as all other important parameters such as fiber attenuation characteristics and so on.		
3.4.7.3.7.	Software shall permit periodic and automatic monitoring as well as recording of optical attenuation in sensing fibers at user-defined intervals		
3.4.7.3.8.	Software shall be capable of allowing remote access and control of the DTS Field Unit upgrade/configuration via Ethernet.		
3.4.8.	DTS CALIBRATOR		

#	DESCRIPTION	REQUIRED VALUE /STANDARD	MANUFACTURER'S CONFIRMATION OR PROPOSAL
3.4.8.1.	The DTS calibrator will contain two sets of fibers that are placed in a carefully controlled temperature environment with input terminals to accept standard optical connectors, defined by the DTS system requirements		
3.4.8.2.	The calibrator should provide two user-settable reference temperatures such as, for example, 70 and 30 ℃, including the possibility to undertake the DTS calibration by applying the thermal environment at the remote cable ends		
3.4.8.3.	The control software should have capability to recalibrate the DTS unit automatically when connected to the calibration unit		
3.4.9.	RAMs	Appendix 1 - RAMs requirements	
3.4.9.1.	The operating lifetime for the DTS system shalSl be:	a minimum of 10 years continuous operation	
3.4.9.2.	The DTS system shall have a minimum mean time between failures (MTBF) of not less than:	MTBF: 50,000 hours	
3.4.9.3.	If an optical switch is used, the mean time between failures shall be greater than:	10 million switch cycles	
3.5	**TECHNICAL DOCUMENTAION**		
3.5.1.	General:		
3.5.1.1	All data (documents, drawings) and descriptive material shall be in English or Hebrew doc/pdf/dwg formats.		
3.5.1.2	Every document/drawing should include:Title document name,date, drawing number, revision number.		
3.5.2.	REQUIRED DOCUMENTS		
3.5.2.1	COMMITMENT BY MANUFACTURER		
3.5.2.2	Valid ISO certificate	ISO 9001- Appendix 2	
3.5.2.3	Valid test reports/calibration certificate from an authorized laboratory for each proposed item.		

#	DESCRIPTION	REQUIRED VALUE /STANDARD	MANUFACTURER'S CONFIRMATION OR PROPOSAL
3.5.2.4	Supplier declaration for Compatibility: Environmental testing, Electromagnetic Compatibility (EMC) and Safety	cluse 2.5.1	
3.5.2.5	DTS System Report, describing the system to be supplied.		
3.5.2.6	Technical documentation stating the following detailes:		
3.5.2.4.1	DTS system power supply requirements, accuracy in temperature measurements, spatial resolution, maximum allowable fiber attenuation at operating frequencies, and measuring intervals, for various fiber ranges.		
3.5.2.7	Schematic overview of the system		
3.5.2.8	User's manual		
3.5.2.9	Maintenance manual, including maintenance prescriptions and schedule		
3.5.2.10	A full calibration procedure document for calibrator		
3.5.2.11	Calibration certificate from an authorized and accredited laboratory stating DTS system accuracy in temperature measurements and spatial resolution		
3.5.2.12	Quick installation and set-up guide, installation diagrams, manual for proper integration of the Field Unit into communication network (this document should describe any network service the Field Unit is supplying)		
3.5.2.13	Field Unit datasheet		
3.5.2.14	All software needs to the DTS system operation		
3.5.2.15	Test Reports (including FAT and SAT) for delivered system		
3.5.2.16	Safety instructions and risk analysis		

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3.6	**SUPPLIER's MAINTENANCE**		
3.5.3.	The period of the maintenance services (including spare parts) shall be from the first supply of the equipment and shall continue for a period of ten years thereafter		
3.7	**Cyber & Information Security**		
3.7.1.	General: The next guidelines, as outlined in this document, apply specifically to the Proof of Concept (POC) stage. If the POC proves successful and client decides to proceed with procuring a DCR system, stricter guidelines will be imposed on the supplier		
3.7.2.	Approval from the Substation Unit is mandatory for all components to be installed within the Substation premises. This includes sensors, server cabinets, workstations, and other equipment		
3.7.3.	If the supplier needs to connect DCR system equipment to existing operational equipment, it is the responsibility of the Substation Unit to grant approval. The Substation Unit must also ensure that the installation poses no electrical hazards		
3.7.4.	Whenever a supplier plans to visit IECo premises, they must first submit a request to the security department. After receiving approval from the security department, the supplier will be allowed entry and will be accompanied by IECo personnel		
3.7.5.	The supplier is responsible for providing all components required for the DCR system. If specific physical workstations (PCs) are necessary for connecting to the system within the Substation Unit, the supplier must provide them		
3.7.6.	All data communication from the DCR system to the supplier's cloud or any other network will be routed through a physical Firewall equipped with a cellular SIM card, ensuring encrypted data transmission (IPSEC)		

#	DESCRIPTION	REQUIRED VALUE /STANDARD	MANUFACTURER'S CONFIRMATION OR PROPOSAL
3.7.7.	During the pilot phase, there will be no communication established between DCR system components and the IECo network		
3.7.8.	The Substation Unit must confirm that there are no electrical hazards associated with the physical connection of the DCR system to the Substation's infrastructure. After this confirmation, data can be securely transmitted to the cloud, and remote access to DCR system data can be granted		
3.7.9.	It is the supplier's responsibility to seek approval from IECo for the DCR system architecture, which will be addressed in detailed design documents. These design documents should cover aspects such as Cybersecurity, Hardware, Software, Databases, Communication, System integration, installation, and maintenance, among others		
3.7.10.	If the Substation Unit identifies electrical hazards related to the connection of the DCR system to the physical infrastructure within the Substation, access to DCR system data will be limited to local access only, following approval of detailed design documents by IECo		

4. APPENDICES

APPENDIX 1 RELIABILITY, AVAILABILITY, MAINTAINABILITY and Safety (RAMs) requirements for 170/420KV DCR system:

1. Operational experience

1.1 The proposed Manufacturer's plant should have at least 9 years of experience in production of at least 170kV to 420kV DCR systems.

1.2 The bidder will provide contact details of at least 5 different customers of the bidder's 170kV to 420kV DCR systems, whose purchase from the last 7 years (more than 1-year experience with bidder's 170kV to 420kV DCR systems).

The reference list for the last 9 years shall include at least 50 units of such equipment supplied for at least 3 different countries and operated successfully for at least 1 year, and purchased during last 7 years. At least one of the countries must be from the EU (European Union) and/or OECD.

Only countries with an electrical transmission system of 170KV and above will be accepted.

1.3 In order to prove compliance with above mentioned, the bidder is required to submit (for example) the following table, duly filled and signed by a qualified officer.

NO.	170/420KV DCR SYSTEM DATA (KV)	QUANTITY	PURCHASER NAME & ADDRESS	SUPPLIED DATE	ENERGIZING DATE	CONTACT DETAILS
1						
2						

1.4 SPARE PARTS - Spare parts shall be available for a period of life duration of 170/420KV DCR system.

2. Reliability

The Bidder shall present the reliability tasks and methods which are used to improve the design for reliability, and evaluate the MTTF/MTBF for (***)Major Failures** only, of the 170/420kV DCR system components.

The Bidder shall provide expected values for the relevant parameters of the 170/420kV DCR system components, and shall add their distribution whenever possible.

3. Failure Analysis

From his Failure Reporting Analysis and Corrective Action System (FRACAS), Bidder shall present a failure report and the analysis of the failures which occurred during the service life of similar 170/420kV DCR system components **manufactured by him**. The report should include the withdrawn conclusion and the corrective actions subsequently undertaken.

***Major failure:** Failure of a Transformer which causes the cessation of one or more of it's fundamental functions.
A major failure will result in an immediate change in the system operating conditions,
e.g the backup protective equipment will be required to remove the fault, or will result in mandatory removal from service within 30 minutes for unscheduled maintenance.

4. 170/420 kV DCR systems RAM DATA

Bidder shall submit the following 170/420 kV DCR system RAM data:

Table 1: DCR system components RAM parameters of similar construction of ratings

Component	MTBF (Yrs)	EOL (Yrs)	MTTR (Hrs)
1. DTS (Distributed Temperature Sensing)			
1.1 DTS Controller			
1.2 Other			

Where:

MTBF: Mean Time Between Failures, For *Major Failure
EOL: Expected Operating Life.
MTTR: Mean Time To Repair, for *Major Failures

5. Field Data

The bidder will fill the following table:

Table 3: Field Demonstrated RAM data for similar construction and ratings DCR system (last 9 years)

Field RAM Data		2015	2016	2017	2018	2019	2020	2022	2023	2024
Total number of installed DCR's										
Major Failures										
Specific Part which undergo Major Failure	DTS controller									
	Other									
Mean Time to Repair/Replace										

6. Unreliability Demonstration Procedure (UDP)/Reliability Test

NOGA IISO could conduct an Unreliability Demonstration Procedure (UDP)/Reliability Test, according to NOGA IISO's Judgement. The manufacturer may request NOGA to see example for a UDP . The final UDP could be change according to each individual case and circumstances, as to be decided by NOGA IISO.

4.1 APPENDIX 2 - Quality Assurance & Quality Control

4.2.1. The Supplier should have a Quality Management System (QMS) having a certificate evidencing compliance with the requirements of the valid revision of ISO 9001 or any other Management System standard specifically indicating that it implements the requirements of ISO 9001, which are valid on the date that specified for submission of the proposal.

4.2.2. Approval of conformance with the ISO 9001 requirements, as indicated in paragraph 9.1 above, should be in a form of a certificate issued by a Certification Body (CB) which is a qualified by an Accreditation Body.

4.2.3. The certificate should bare the logo of the CB and of its Accreditation Body and/or the logo of the IAF MLA.

4.2.4. The certificate should be valid on the date set for submission of the proposal.

4.2.5. The certificate should be valid for the scope of activities requested in the request for proposal.

4.2 APPENDIX 3- COMMITMENT BY MANUFACTURER

4.3.1. DEVIATIONS FROM REQUIREMENTS:

Manufacturer is requested to describe or indicate deviations of the equipment and accessories from all requirements in this SYSTEM REQUIREMENTS document.

4.3.1.1. COMMENTS BY MANUFACTURER:

4.3.2. In case no deviations are mentioned it will be understood that Manufacturer's offer entirely complies with all requirements in this SYSTEM REQUIREMENTS document.

Manufacturer hereby certifies that he agrees to all provisions and conditions of this SYSTEM REQUIREMENTS document of NOGA ISO (Israel Independent System Operator), which including the accompanied Appendices documents unless exceptions are specifically and clearly listed (see cl .4.3.1) and identified as Exceptions.

Manufacturer's Commitment:

NAME	COMPANY	DATE	SIGNATURE OF MANUFACTURER