

TERMS OF REFERENCE
for design and installation of structured cable system for NCFM

1. General provisions

- 1.1. The facility is located in the main production building of NCFM (77 Stefan cel Mare și Sfânt Ave.).
- 1.2. The facility has 2 floors.
- 1.3. The main purpose of the project is to renew existing cabling infrastructure in the whole building as well as in server rooms.
- 1.4. Project requirements for design and implementation are defined by herby documents:
 - 1.4.1. These terms of reference (ToR)
 - 1.4.2. Contract
 - 1.4.3. Conclusion on technical inspection of the object
 - 1.4.4. The standard of telecommunication cable systems – ANSI / TIA / EIA-568-B (568-B)
 - 1.4.5. Information technology — Generic cabling for customer premises – ISO 11801
 - 1.4.6. Telecommunications Infrastructure Standard for Data Centers – ANSI / TIA 942
 - 1.4.7. Information Technology – Generic Cabling Systems – EN 50173
 - 1.4.8. Electrical installations standards and norms:
 - 1.4.8.1. СНиП 3.05.06-85 “Электротехнические устройства”
 - 1.4.8.2. Norme de Amenajare a Instalațiilor Electrice (ПУЭ rev. 7)
- 1.5. To this ToR, the Customer attaches the floor plans of the premises necessary for performing the work (Annex 1).
- 1.6. Workplaces location will be approved mandatory in the process of project design. Before any design work starts Contractor must be familiarized with NCFM's purpose of the premises, the locations of the risers and cabinets of low-current systems, the placement of beams, air ducts, and other protruding structures. The design should be coordinated with all interested institutions. Performance of any changes and additions to this TOR are formatted in accordance with the established procedure and are inalienable annexes to it.
- 1.7. The Contractor and Customer must approve the final documentation, as well as all technical project before the work starts.
- 1.8. Contract defines terms and stages of work execution.
- 1.9. At the end of work, the Contractor must provide the executive documentation, technical project with latest changes.
- 1.10. The current TOR defines the requirements for the following subsystems:
 - 1.10.1. Local internet network;
 - 1.10.2. Local phone network;
 - 1.10.3. Power supply system for Data Centers and workplaces;
- 1.11. Work and material quantities are estimated but not exhaustive, the Contractor must evaluate all the quantities himself, based on an individual inspection of the NCFM building.
- 1.12. NCFM specialists are ready to work together, cooperate to provide all the details so that the contractor offers a solution as optimal as possible and close to the NCFM's wishes.

2. Structured cabling system (SCS)

2.1. Basic provisions.

- 2.1.1. The low-current cable system of the facility should be built based on structured cabling.
- 2.1.2. Structured cabling system should be a conceptual solution that can meet current and future communication needs.
- 2.1.3. The warranty life of the SCS system must be at least 15 years.
- 2.1.4. SCS should support all low-current equipment, voice and video information terminals and provide the ability to connect these devices using standardized connectors.
- 2.1.5. SCS must be high reliable and fault tolerant.
- 2.1.6. Functionality should not depend on the movement of units or individual employees.
- 2.1.7. SCS should be designed with aim of a modular structure, which allows further enhancement by connecting new network equipment and workplaces.

2.2. SCS requirements:

- 2.2.1. The structure and architecture of the SCS should comply with international standards that describe the construction of structured cabling systems (ISO / IEC 11801, ANSI TIA / EIA-568B, ANSI TIA / EIA-942, EN 50173).
- 2.2.2. The cable system must be tested and marked in accordance with the ANSI TIA / EIA-568B, ANSI TIA / EIA-606A standard.
- 2.2.3. All cables must be marked at all access points of the maintenance personnel to the line-cable and electronic equipment of the systems.
- 2.2.4. After performing the installation or repair work, the SCS lines should be tested for compliance with the requirements of the latest edition of the international standard ISO 11801. Customer is provided with the measurements protocols.
- 2.2.5. SCS should be built using a 4-pair foil shielded (F) with foil screened twisted pairs (FTP), low smoke free of halogen (LSHF) cable category 6 or higher.
- 2.2.6. Each 4-pair cable are to be terminated in a separate 8-way socket (RJ45 Cat 6 or higher).
- 2.2.7. Low-current and power cables must be laid at least 3 cm apart. When laying the cable, it is necessary to use a box with a dividing partition (min. 4 Ω) and be equipped with all necessary decor elements (corners, plugs, sockets).
- 2.2.8. All components of SCS (cable, sockets, patch panels, patch cords) must comply with the requirements of IEC 60603-7 and meet the requirements of TIA / EIA-568-B.2 for category 6 or higher, also must have certificates of quality.
- 2.2.9. Cabling must be routed:
 - 2.2.9.1. Indoors – in the cable channel (in the box) with a size of min. 80x40, while the power cables must be separated, by means of a cable splitter (min. 4 Ω), from low-current cables.
 - 2.2.9.2. In the attic – the SCS should be laid through a non-perforated metal cable channel with a stained lid.
- 2.2.10. The system of cable channels must meet the requirements of the adopted standards and do not infringe the design and interior of the premises.
- 2.2.11. Free space in the cable channel should be at least 30%.
- 2.2.12. Intermediate distribution units (IDF) are located in the room Server Room 1&2 on the 2nd floor, according to the layout of the premises, which locates racks with patch

panels, active and passive network equipment. All these distribution units are in constant operation, i.e. in the operating mode.

2.2.13. All cables coming to the intermediate distribution units from the operating rooms must be punched down on the reverse side of the patch panels. Appropriate markings must be made on the front side of the patch panels and user ports. The marking must be clear and not cause discrepancies.

2.2.14. Furniture or other obstacles that will interfere with the work process will be moved away by the Contractor staff with further placement to their initial position.

2.2.15. To ensure convenient access to all equipment installed in the server room, it is necessary to rearrange existing equipment and switch racks.

2.3. Phone line requirements

2.3.1. All requirements as described in 2.2;

2.3.2. The phone lines must be punched down on the crossover panel located in Server 1 and Server 2. Firstly the phone lines should be punched down on the back of patch panels in the rack cabinet, secondly from rack cabinet to the crossover panel.

2.4. Requirements for workplaces equipment

2.4.1. Each common workstation should be equipped with one two-port RJ-45 socket and two 220 V red power sockets only for powering the computer power supply system.

2.4.2. The location and number of connection points should be determined in accordance with the building schema attached to this TOR (Annex 1), as well as taking into account possible permutations and installation of additional workplaces.

2.4.3. 220 V power sockets must have a grounding contact and correspond to the type of plugs CEE 7/4 (Schuko).

2.4.4. All sockets must be installed in the box in a way that enables possibility of movement by 1.0 – 1.5 m from the installation point along the cable channel;

3. Power supply system

3.1. Each newly equipped workplace of the employee requires installation of two (2) power electrical outlets of the technological (computer) power supply group.

3.2. It is strictly prohibited to connect power outlets in series.

3.3. Installation of electrical outlets is carried out in cable channel (halogen free), at an elevation of 300 mm. from the floor, except for specially stipulated cases.

3.4. The cable laying is carried out:

3.4.1. Indoors – on the walls in the cable channel with a size of min. 80x40, while the power cables must be separated from low-current cables, by means of a cable splitter (cable channel divider, min. 4 Ω); (*Note: The cable channel in all rooms must be of the same shape and size.*)

3.4.2. In the attic – the power cable should be laid through second non-perforated stained metal cable channel with a stained lid.

3.5. Internal electrical networks are made with LSHF solid copper conductor cables 8.2

3.6. Design and implementation of power supply solution must provide high reliability, uninterruptable flow of current by connecting a second source of power to an automatic transfer switch with aim to provide constant energy flow to Server rooms and workplaces.

- 3.7. The metallic cable channel, racks, electrical circuits and equipment must be connected to the grounding contour of the building, tested by the contractor at the start of the works. The grounding works will be certified and confirmed by the appropriate acts.
- 3.8. Work should be performed in accordance with the requirements of the (Norme de Amenajare a Instalațiilor Electrice (ПУЭ rev. 7)).

4. Requirements for materials, equipment, diagnostics and metrological support.

- 4.1. Work on equipment, materials, components, etc. should be performed in accordance with ISO 9000 - 9001 series.
- 4.2. When submitting works, Contractor carries out tests of the SCS.

5. Requirements for completeness.

- 5.1. The equipment and installation products should be equipped in accordance with the design results.

6. List of works

- 6.1. Reconstruction of the SCS is performed in the corridors of 1-2 floors and in the premises of 1-2 floors.
 - 6.1.1. Disconnection and removal of outlets at workplaces;
 - 6.1.2. Dismantling of the cable system;
 - 6.1.3. Dismantling of cable channel and metal cable channel;
 - 6.1.4. Furniture shifting and installation to its original position;
 - 6.1.5. Installation of cable channel (halogen free) and metal cable channel for cable laying;
 - 6.1.6. Installation of sockets at workplaces;
 - 6.1.7. Installation of a cable system and connection of outlets;
 - 6.1.8. Connection to the crossover of low current cables from the connection points;
 - 6.1.9. Installation and cross patching of switching equipment (patch panels).
- 6.2. Repair of SCS includes:
 - 6.2.1. Replacement and connection of outlets to workplaces (if necessary);
 - 6.2.2. Replacement of the cable system (if necessary);
 - 6.2.3. Replacement and cross patching of switching equipment (patch panels) (if necessary)

7. Estimated amounts of materials: Contractor must estimate all the quantities by himself based on in person NCFM facility inspection.

- 7.1. Cat6 RJ-45 modules: ~1000 pcs;
- 7.2. Fiber Optic Cable (Single Mode type "A" 1275-1625 nm): (Contractor must estimate all the quantities by himself based on in person NCFM facility inspection);
- 7.3. Modular Fiber Optic Patch Panel with 24*SC/SC installed modules: 2 pcs;
- 7.4. Modular Outlets (2*power modules): ~250 pcs;
- 7.5. Modular Outlets (2*RJ-45): ~250 pcs;
- 7.6. Modular Cat6 Patch Panel 24*RJ45: ~22 pcs;
- 7.7. F/FTP Cat6 cable: (Contractor must estimate all the quantities by himself based on in person NCFM facility inspection);
- 7.8. Non-perforated metal cable channel with a stained lid: (Contractor must estimate all the quantities by himself based on in person NCFM facility inspection);
- 7.9. Cable channel (white, halogen free): ~ (Contractor must estimate all the quantities by himself based on in person NCFM facility inspection).

Note: Racks and switches will be provided by NCFM.

8. Cable requirements

8.1. Data/phone cable

- 8.1.1. Type: Cat6 F/FTP
- 8.1.2. Conductor size: 23 AWG
- 8.1.3. Insulation: PE
- 8.1.4. Twisting element: pair
- 8.1.5. Twisting: 4 pairs over cross element
- 8.1.6. Overall screen: aluminium-bonded polyester tape, metal side inside, with underlayered tinned, copper drain wire
- 8.1.7. Outer sheath: halogen free, flame retardant compound
- 8.1.8. Fire behavior:
 - 8.1.8.1. Flame resistance: acc. to IEC 60332-1-2
 - 8.1.8.2. Halogen free: acc. to IEC 60754-1/2
 - 8.1.8.3. Smoke resistance: acc. to IEC 61034-1/2
 - 8.1.8.4. Fire load (MJ/m): 0.7 (approx.)
- 8.1.9. Performance:
 - 8.1.9.1. Better than category 6 acc. to EN 50288 and IEC 61156
 - 8.1.9.2. Bandwidth (typical): min. 250 MHz
- 8.1.10. Applications:
 - 8.1.10.1. Installation cable for generic cabling systems acc. to ISO/IEC 11801 and EN 50173 (2nd edition). Ideal for all applications of class D up to E up to 1 GbE acc. to IEEE 802.3 ab, VoIP, PoE/PoE+
- 8.1.11. Mechanical characteristics:
 - 8.1.11.1. Bending radius:
 - 8.1.11.2. During laying: 8 x outer diameter (min.)
 - 8.1.11.3. Acc. to Installation: 4 x outer diameter (min.)
 - 8.1.11.4. Tensile loading (N): 220 (max.)
 - 8.1.11.5. Crush resistance (N/100mm): 1000
 - 8.1.11.6. Impact strength (quantity of impacts): 10
- 8.1.12. Electromagnetic behavior:
 - 8.1.12.1. Transfer impedance at 10 MHz (mOhm/m): 50 (nominal value)
 - 8.1.12.2. Screen attenuation up to 1000 MHz (dB): 60 (nominal value)
 - 8.1.12.3. Coupling attenuation up to 1000 MHz (dB): 70 (nominal value)

8.2. Fiber optic cable

- 8.2.1. Type: Fiber optic 24 wire type A (1275-1625 nm)
- 8.2.2. Fire behavior:
 - 8.2.2.1. Flame resistance: acc. to IEC 60332-1-2
 - 8.2.2.2. Halogen free: acc. to IEC 60754-1/2
 - 8.2.2.3. Smoke resistance: acc. to IEC 61034-1/2
 - 8.2.2.4. Fire load (MJ/m): 0.7 (approx.)

8.3. Electrical cable

- 8.3.1. For workplaces – N2XH-J (min 3x2.5)

- 8.3.1.1. Technical data:
 - 8.3.1.1.1. Nominal voltage: 0,6/1 kV;
 - 8.3.1.1.2. Amperage: min. 16A;
- 8.3.1.2. Construction:
 - 8.3.1.2.1. Conductor: Solid red copper conductor Cl. 1, acc. to IEC 60228;
 - 8.3.1.2.2. Color cores: acc. to IEC 60446;
 - 8.3.1.2.3. Wrapping: halogen-free filling compound, pressed;
- 8.3.1.3. Resistance:
 - 8.3.1.3.1. Flame retardant acc. To: IEC 60332-3, EN 50266-2;
 - 8.3.1.3.2. Halogen free acc. to: EN 50267-2-1, IEC 60754-1;
 - 8.3.1.3.3. Low corrosiveness combustion gases acc.to: EN 50267-2, IEC 60754-2;
 - 8.3.1.3.4. Low smoke emission acc. to: EN 50268-2, IEC 61034-2;
- 8.3.1.4. Features:
 - 8.3.1.4.1. Insulation integrity under flame propagation to IEC 60331;
- 8.3.2. For server rooms – N2XH-FE-180/E90
 - 8.3.2.1. Technical data:
 - 8.3.2.1.1. Nominal voltage: 1,5-2,5 kV;
 - 8.3.2.1.2. Amperage: min. 21 A;
 - 8.3.2.2. Construction:
 - 8.3.2.2.1. Conductor: Solid red copper conductor Cl. 1, acc. to IEC 60228;
 - 8.3.2.2.2. Insulation: core insulation with cross-linked, polyethylene, type 2XI1
 - 8.3.2.2.2.1. core with double insulation;
 - 8.3.2.2.2.2. flame retardant MICA-tapeover conductor;
 - 8.3.2.2.3. Color cores: acc. to IEC 60446;
 - 8.3.2.2.4. Wrapping: halogen-free filling compound, pressed;
 - 8.3.2.3. Resistance:
 - 8.3.2.3.1. Flame retardant acc. To: IEC 60332-3, EN 50266-2;
 - 8.3.2.3.2. Halogen free acc. to: EN 50267-2-1, IEC 60754-1;
 - 8.3.2.3.3. Low corrosiveness combustion gases acc. to: EN 50267-2, IEC 60754-2;
 - 8.3.2.3.4. Low smoke emission acc. to: EN 50268-2, IEC 61034-2;
 - 8.3.2.4. Features:
 - 8.3.2.4.1. Insulation integrity under flame propagation to IEC 60331;
 - 8.3.2.4.2. FE 180: insulation integrity for 180 min. IEC 60331;
 - 8.3.2.4.3. E 90: functionally for 90 min.;

9. Work finalization implies following:

- 9.1. Testing;
- 9.2. Checking the electrical system for short circuits;
- 9.3. Measurement of insulation resistance of wires and cables;
- 9.4. Performing commissioning works;
- 9.5. SCS and equipment certification;
- 9.6. Issuing execution documentation;
- 9.7. Provision of latest technical project;
- 9.8. Provision to the Contractor of all reports and above mentioned documents, including measurement protocols.

10. Documentation requirements.

- 10.1. All work should be carried out only after the Customer approves the project for the execution of works.
- 10.2. After performing the work, the Contractor submits to the Customer the executive documentation for the SCS consisting of:
 - 10.2.1. Explanatory note;
 - 10.2.2. Acceptance certificate;
 - 10.2.3. Drawings of the basic set, including:
 - 10.2.3.1. SCS structural diagram;
 - 10.2.3.2. Single-line power supply schemes;
 - 10.2.3.3. Diagrams for the location of workplaces and cable routes on the floors of the building;
 - 10.2.3.4. Executive documentation for power supply system;
 - 10.2.3.5. Tables of general connections and connections of SCS cables.
 - 10.2.3.6. Program, methodology and results of testing of SCS cable network.
 - 10.2.4. Execution schemes for the location of workplaces - detailed plans with the indication of cable routes, the location of outlets, the numbering of telecommunications ports, as well as the layout of equipment in telecommunications cabinets.
 - 10.2.5. A cable log containing information on cable numbers, the direction of their laying (where it goes and where it comes from), equipment name or designation, as well as the connection points (cross-connects, termination) of cable cores, designation of combs, plinths, etc., cable brand, the number of pieces of cable and the estimated length.

11. Safety requirements

- 11.1. Works are carried out in accordance with the requirements of fire safety, industrial safety and labor protection.
- 11.2. Contractor's employees who directly perform construction and installation work must have electrical safety certificates not lower than Group 2 of the admission, must be provided with serviceable tools and accessories, working clothes and work shoes, and personal protective equipment.
- 11.3. The design and installation of all systems should exclude the possibility of touching maintenance personnel to live parts.

12. Rules for the control and acceptance of work.

- 12.1. The acceptance of the completed scope of work is carried out by the Customer's representative both for individual types of work, and after the completion of the work carried out in accordance with the TOR, estimate and contract for the performance of work.
- 12.2. Design of the project and documentation for all sections should be made using a computer graphics program and submit its agreed and approved version to the Customer in electronic form and on paper.

13. Warranty of work execution

- 13.1. The executor must guarantee the quality and terms of the works performed in accordance with the contract. The warranty period of normal operation of the facility and its engineering systems, equipment, materials and works is 15 years from the day of acceptance of the works performed.