

TECHNICAL SPECIFICATIONS

The General Conditions & Technical Specifications for the Civil, Mechanical and Electrical Works issued by the Ministry of Housing & Construction are part of the Contract Documents

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Technical specifications

The purpose of this project is to execute necessary maintenance works for the school building including the maintenance of the electrical network, doors and windows in addition to tiling the classrooms, yards and walls and providing the missing items (lighting devices, faucets, toilets) as well as providing aluminum windows and wooden doors instead of the damaged ones. Moreover, the works includes maintaining the students' WC facility and drinking facility in addition to maintaining the wastewater and potable water networks and replacing the damaged parts with new ones, cleaning and draining the toilets and blocked sewages and cleaning the existing ceramic tiles. Furthermore, the works include executing new WC and drinking facilities in the yard (separately for each of male and female students) to increase the number of toilets in each school at least to meet the required number, i.e. one toilet per 30 girls and one toilet per 60 boys, in addition to providing plastic water tanks to increase the water storage capacity at each school and provide electrical pumps and executing extra drinking facilities in the yards. All the above shall be carried out according to the quantities table for each school and in line with the following technical specifications:

i. Civil and Architectural Works:

1. Executing WC facilities in the yards
2. Maintaining the existing woodworks and their accessories
3. Providing and installing new woodworks with their accessories
4. Providing and installing new aluminum windows
5. Maintaining the existing aluminum windows and their accessories
6. Maintaining the metal works (doors, windows, rails, etc.)
7. Providing and installing wrought iron grilles
8. Cleaning the WC and drinking facilities
9. Providing new drinking facilities for the students
10. Tiling and ceramic works
11. Cement and brick blocks works
12. Cement rendering works
13. Paint works
14. Mural paintings in the corridors and classrooms
15. Roof tiling works
16. Extension joints works
17. Roofs water insulation works: maintaining the existing insulation and providing and executing a new insulation system
18. Marble and stone works
19. Regular and reinforced concrete works
20. Repairing the damaged constructional elements
21. Sandwich panel works
22. Asphalt mixture works

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23. Digging and backfilling works
24. Demolishing and removal works
25. Site cleaning and waste transferring works

ii. Mechanical and sanitary works:

1. Providing and installing a wastewater network
2. Providing and installing a potable water network
3. Cleaning and draining the WC facilities and sewers
4. Cleaning, draining and unblocking the main sewer
5. Providing and installing a water pump with a metal protection box
6. Providing and installing plastic water tanks
7. General conditions for the sanitary parts/fittings

iii. Electrical works

1. Providing and installing main and secondary electric distribution panels in addition to wiring the sockets and switches
2. Providing and installing electrical breakers
3. Providing and installing complete lighting points
4. Providing and installing electrical outlets
5. Providing and installing lighting devices (bulbs with sockets, complete fluorescent light units, fluorescent bulbs, etc.)
6. Maintaining the electrical network and removing short circuits/contacts

All the aforementioned works shall be subject to the following special technical conditions in addition to the General Conditions & Technical Specifications Book for the Civil, Architectural, Mechanical, Sanitary and Electrical Works issued by the Ministry of Housing & Construction.

I. Civil & Architectural Works:

Important Remarks:

- a) The bidding contractor shall submit technical bulletins and samples of the materials to be used in the execution of the project during the tender stage (marble, faucets, ceramic, wiring accessories, sanitary parts, and various accessories).
- b) The bidding contractor shall submit a study and structural and architectural plans for the WC facilities with some other different details in accordance with the initial drawings attached to the tender file (drinking facility, new wooden doors and others) as well as a timescale for the execution of the works.
- c) The contractor shall appoint a number of engineers (at least 1) to follow up the execution of the project.
- d) The contractor shall prepare at the worksite an office for the supervising engineers appointed by the organization and shall equip it with a desk, chairs, water dispenser, lighting equipment, stationery, small gas cooker, a kitchenette equipment and janitor. In case of failure to provide the above, a monthly amount of SYP50,000 shall be deducted from his account
- e) The contractor shall be fully responsible for the storage of materials supplied for the execution of the project.

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- f) The Contractor shall abide by the conditions of occupational safety at the site: warning tapes, warning plates, helmets, gloves, protective shoes and uniform jackets for workers, protective ropes for high places, scaffolding, protective masks, etc.
- g) The contractor shall be responsible for protecting the furniture inside the building during the course of the work and taking all measures to preserve it from dirt and damage. In case he has to move or relocate the furniture, he must return it to its place immediately upon the completion of the work inside the place.

1. Executing Students' WC Facilities in the Yard:

Providing and installing a students' WC facility room in the yard made from a reinforced concrete structure (concrete posts with a 30cm concrete base and at least a 12cm reinforced concrete roof and cement block copings). Both the concrete base and roof shall protrude off the external walls by 25cm at three sides and by 90cm at the room entrance. The room shall be 3 steps above the ground level. The external walls shall be made from 20cm thick cement blocks from the exterior and 10cm thick cement blocks from the interior, according to the plans, architectural and constructional sections attached. The location of the room in the yard shall be determined in cooperation with the project and school administrations. The contractor shall provide a plan for the school yard to show the room location and obtain the school administration and engineer's approval before starting the works. The WC facility's entrances shall be made in a location easy-to-monitor by the teaching staff. In all cases, the contractor shall provide a detailed architectural and constructional study for this room according to the Syrian Code together with a price quotation. The UNDP's technical team may request some modifications on the constructional plan and adding some elements, if necessary, to be later adopted.

The WC facility room has at least 4 squat toilets with chrome siphons and 3 sinks according to the plans attached to the WC facilities. The room internal dimensions shall be 3x4m and 2.7m high. There are special cases where the WC facility rooms have bigger dimensions (as illustrated in the quantities tables and the special plans attached). Each toilet shall be equipped with a faucet and metal hose. The partitions between the toilets shall be made from 10cm thick plastered blocks (see the cement plaster specs) and Syrian-made ceramic tiles, grout and adhesive. The room floor shall be tiled with non-slippery Syrian-made ceramic tiles. The sinks shall be made from white porcelain (at least 45x55cm) installed on a low column, according to the opinion of the supervising engineer, taking into account the school children's age. This provision and installation of the sinks shall include all required fittings and accessories, mirrors, shelves, faucets and soap dishes. The interior walls shall be covered with a regular layer of plaster tiled with ceramics up to the ceiling, which shall be painted with at least 3 layers of plastic paint until fully covered. The room shall be equipped with exterior iron doors made from a metal structure and two layers of metal sheets with holes for lighting and ventilation in addition to providing all the required accessories, metal hinges and lock (ISO or an equivalent brand). The metal doors shall be painted with at least 2 layers of anti-corrosion epoxy paint then with a final thermally sprayed layer (silver color). The interior doors shall be made from sections of aluminum (an external frame with 2 rails) and colored fiber panels (pink for the girls' room and blue for the boys') (at least 4mm thick). Each of the room's interior/exterior doors and windows shall be equipped with 2-3cm marble frames the same width of the wall to have the door/window installed on them. The aluminum doors and windows shall be equipped with the required accessories including locks, handles and hinges (see the special item on the aluminum works specs). Each room shall be equipped with at least 10-inch extractor fan as well as aluminum slide windows, according to the plans, with oil paint-coated protection grilles. The room shall also be equipped with four 20w energy-saver bulbs and an interior spot light in addition to a 40w energy-saver bulb with a cover mounted on the exterior entrance shade. Moreover, the room shall be equipped with a special electric breaker. The number of the devices shall be as follows:

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Number of Toilets	Number of lighting points
A room with 1 toilet	One 20w energy-saver bulb with an interior lighting cover and one 40w bulb for exterior lighting
A room with 2 toilets	Two 20w energy-saver bulbs with an interior lighting cover and one 40w bulb for exterior lighting
A room with 3 toilets	Three 20w energy-saver bulbs with an interior lighting cover and one 40w bulb for exterior lighting
A room with 4 toilets	Four 20w energy-saver bulbs with an interior lighting cover and one 40w bulb for exterior lighting

Moreover, the room shall be equipped a 1m³ three-layered plastic water tank (see the plastic tanks specs) with varied diameters PPR pipes connected to it, as required, in addition to valves and required fittings. The work shall also include the installation of an outdoor drinking facility (basin) made from 3cm thick marble as well as tiling the wall on which the basin shall be fixed with Syria-made ceramics up to 150cm high according to the details attached with the potable water PPR pipes (see the potable water plumbing specs) in addition to providing long-necked faucets. The room shall be externally covered with colored cement render in regular ratios, two layers with harsh render or three layers of regular render with a rough external paint. The room color shall be selected by the supervising engineer. The price shall include connecting the room with the electrical grid and the school potable water network as well as the plastic water tank and the sewage system (the nearest sewer) and executing a complete external sewer, or more, if necessary. The room shall also be equipped with an appropriate number of drains, sewers and manholes, indoor and outdoor, to ensure good drainage for the sinks, toilets and the drinking facility. The sewage system shall be made of UPVC pipes of varied diameters and accessories (with the cleaning and draining of the sewer and sewage line to which they will be connected). The price shall include the making of platforms, steps and pavements, at least 120-150cm wide, around the room to ensure safe passage for users. All the interior and exterior doors and windows shall be fixed on 3cm thick polished and beveled marble covering the entire wall width. Moreover, marble threshold tiles shall be provided and installed for the interior and exterior doors. Samples of all the materials and colors shall be submitted to the supervising engineer to approve before executing the works. The price shall include all required labor costs, transport, profits, non-durables and other costs required for the completion of work in the optimum way.

The contractor shall ask for the approval of the materials to be used, their brands and colors according to the adopted sample, as well as samples of the floor and wall ceramic tiles, marble and pavement tiles, sanitary items, electric fittings and accessories, matte and oil paint and exterior rendering materials. The samples shall be executed prior to the procurement of the materials to the worksite.

2. Executing Teachers' WC facilities in the Yard:

Providing and installing a teachers' WC facility room in the yard made from a reinforced concrete structure (concrete posts with a 30cm concrete base and at least a 12cm reinforced concrete roof and cement block copings).

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Both the concrete base and roof shall protrude off the external walls by 25cm at four sides. The room shall be 3 steps above the ground level. The external walls shall be made from 20cm thick cement blocks from the exterior and 10cm thick cement blocks from the interior, according to the plans, architectural and constructional sections attached. The location of the room in the yard shall be determined in cooperation with the project and school administrations. The contractor shall provide a plan for the school yard to show the room location and obtain the school administration and engineer's approval before starting the works. The WC facility's entrances shall be made in a location easy-to-monitor by the teaching staff. In all cases, the contractor shall provide a detailed architectural and constructional study for this room according to the Syrian Code together with a price quotation. The UNDP's technical team may request some modifications on the constructional plan and adding some elements, if necessary, to be later adopted.

The WC facility has a room with a toilet seat with a sink according to the plans attached to the WC facilities. The room internal dimensions shall be 165x305cm and 2.7m high. Each toilet shall be equipped with a faucet and metal hose. The partitions between the toilets shall be made from 10cm thick plastered blocks (see the cement plaster specs) and Syrian-made ceramic tiles, grout and adhesive. The room floor shall be tiled with non-slippery Syrian-made ceramic tiles. The sinks shall be made from white porcelain (at least 45x55cm) installed on a low column. This provision and installation of the sinks shall include all required fittings and accessories, mirrors, shelves, faucets and soap dishes. The interior walls shall be covered with a regular layer of plaster tiled with ceramics up to the ceiling, which shall be painted with at least 3 layers of plastic paint until fully covered. The room shall be equipped with exterior iron doors made from a metal structure and two layers of metal sheets with holes for lighting and ventilation in addition to providing all the required accessories, metal hinges and lock (ISO or an equivalent brand). The metal doors shall be painted with at least 2 layers of anti-corrosion epoxy paint then with a final thermally sprayed layer (silver color). The interior doors shall be made from sections of aluminum (an external frame with 2 rails) and colored fiber panels (at least 4mm thick). Each of the room's interior/exterior doors and windows shall be equipped with 2-3cm marble frames the same width of the wall to have the door/window installed on them. The aluminum doors and windows shall be equipped with the required accessories including locks, handles and hinges (see the special item on the aluminum works specs). Each room shall be equipped with at least 10-inch extractor fan as well as aluminum slide windows, according to the plans, with oil paint-coated protection grilles. The room shall also be equipped with two 12w LED bulbs and an interior spot light in addition to a special electric breaker. The number of the devices shall be as follows:

Number of Toilets	Number of lighting points
A room with 1 toilet	One 20w energy-saver bulb with an interior lighting cover and one 40w bulb for exterior lighting
A room with 2 toilets	Two 20w energy-saver bulbs with an interior lighting cover and one 40w bulb for exterior lighting
A room with 3 toilets	Three 20w energy-saver bulbs with an interior lighting cover and one 40w bulb for exterior lighting
A room with 4 toilets	Four 20w energy-saver bulbs with an interior lighting cover and one 40w bulb for exterior lighting

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Moreover, the room shall be equipped a 0.5m³ three-layered plastic water tank (see the plastic tanks specs) with varied diameters PPR pipes connected to it, as required, in addition to valves and required fittings. The room shall be externally covered with colored cement render in regular ratios, two layers with harsh render or three layers of regular render with a rough external paint. The room color shall be selected by the supervising engineer. The price shall include connecting the room with the electrical grid and the school potable water network as well as the plastic water tank and the sewage system (the nearest sewer) and executing a complete external sewer, or more, if necessary. The room shall also be equipped with an appropriate number of drains, sewers and manholes, indoor and outdoor, to ensure good drainage for the sinks, toilets and the drinking facility. The sewage system shall be made of UPVC pipes of varied diameters and accessories (with the cleaning and draining of the sewer and sewage line to which they will be connected). The price shall include the making of platforms, steps and pavements, at least 120-150cm wide, around the room to ensure safe passage for users. All the interior and exterior doors and windows shall be fixed on 3cm thick polished and beveled marble covering the entire wall width. Moreover, marble threshold tiles shall be provided and installed for the interior and exterior doors. Samples of all the materials and colors shall be submitted to the supervising engineer to approve before executing the works. The price shall include all required labor costs, transport, profits, non-durables and other costs required for the completion of work in the optimum way.

The contractor shall ask for the approval of the materials to be used, their brands and colors according to the adopted sample, as well as samples of the floor and wall ceramic tiles, marble and pavement tiles, sanitary items, electric fittings and accessories, matte and oil paint and exterior rendering materials. The samples shall be executed prior to the procurement of the materials to the worksite.

Additional Important Remarks on the WC Facilities Works:

The works shall include spraying the logos of the UNDP and Ministry of Education (approximate dimensions: 50x90cm) on the exterior walls of the students' WC facilities. The contractor shall provide the sprayers and required colors and spray the logos according to the sample provided by the UNDP.

The contractor shall be fully responsible for all the excavation works and preparing and surrounding the worksite with walls (taking into account that building these facilities shall be outside the school working hours). The price shall also include all the electrical devices, wires and cables and sanitary pipes required for connecting these rooms to the electric grid and the potable and wastewater networks in addition to the costs of transporting the materials, cleaning the worksite and removing the waste to the city's landfill.

The works of maintaining the existing woodworks and their accessories:

- a. Wooden doors: General maintenance to the wooden doors in classrooms. The work includes replacing the entire existing lock – roller bolt – (ISO, Yale or an equivalent brand) in addition to a round or rectangular stainless steel handle, at least 25cm long, and providing and installing hinges to replace the damaged or missing ones as well as providing and installing a door closer. Moreover, damaged wooden parts shall be replaced with beech pine pane wooden parts (frames, jambs, casings, at least 12mm for the jambs, with a width similar to the existing jambs). The wood shall have no knots. The price shall include restoring the plaster around the wood elements in addition to fixing the frames and jambs, calibrating the door movement properly and restoring the broken plaster around the doors. Moreover, the price shall include painting the wooden doors with at least 3 layers to fully cover it after filling the spaces with paste and sanding it until the supervising engineer approves the work.

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The price shall, furthermore, include all the materials required for the completion of works as well as transporting the damaged items to the approved landfills.

- b. In minor maintenance, when the handle is replaced, the handle and trim plates shall be robust, have no sharp edges and safe to use.
- c. Wooden windows: The works shall include replacing the damaged wooden parts with new ones made from beech pine knotless wood that has the same thickness of that of the replaced parts. Moreover, it shall include replacing the damaged locks, handles and hinges and installing new ones instead of the missing ones. The supplied materials shall have the engineer's prior approval before being installed. The works includes restoring the plaster around the wooden elements, calibrating the movement of the windows and fixing the panes with paste after removing the existing one, as per the engineer's opinion. Moreover, the price includes peeling off the old paint, sanding, proper pasting and 3 layers of oil paint.
- d. The provision of all the materials to be used shall be borne by the contractor, who shall obtain the supervising engineer's prior approval before providing and installing the materials.

Providing and installing new woodworks with their accessories:

Wooden doors: Providing and installing complete doors for the classrooms made from hard beech pine wood in line with the original design of the existing ones, for each school separately, with frames made from 18mm plywood and top frames and jambs. The dimension of the door panels shall be measured on site; the panel shall be at least 4.5cm thick and the jambs, heads and sills shall be made from hard beech pine wood (at least 15cm wide) and the doors from knotless hard beech pine wood. Moreover, the casings shall be made from 4.5cm thick beech pine wood. The plaster around the wooden elements shall be restored (see the technical specs of the woodworks below) and the hinges (at least 3), the roller bolt shall be ISO, Yale or an equivalent brand. The handles shall be at least 25cm long and made from stainless steel. They shall be safely fixed allowing a hand to pass behind them. Moreover, the price shall include providing and installing a door closer available in the local market. It shall include sanding and pasting with 3 layers as well as three layers of oil paint until fully covering. Further, it shall include restoring the plaster around the door parts and removing the old doors remnants and accessories (and delivering the damaged parts to the school administration) and transferring the damaged materials to the approved landfills.

The wooden windows: Providing and installing panels, frames and casings made from knotless beech pine wood. The thickness of panels shall be identical to that of the existing ones. The same shall apply to the frames, casings, hinges, handles and locks. All that is mentioned in the wooden doors specifications shall apply to frames and casings. The dimensions shall be measured on site. Each panel is made from a wooden frame with a 6mm transparent pane fixed with paste nails specially used with wood. The price shall include restoring the missing parts of the plaster around the windows, sanding the wood, 3 layers of paste, 3 layers of oil paint, delivering the old windows to the school administration and transferring the damaged materials to the approved landfills.

Wooden closets: Closets dimensions are 60x120x220cm, and are made from 18mm European or Malaysian MDF coated on both sides with European Melamine. All the edges shall be covered with a 2mm thick PVC tape. The closets' top shall be made from 6mm thick MDF with its interior side coated with European Melamine and the exterior painted with sealer or lacquer. The closets shall be made up of two parts each with shelves and panels of the same specifications. The top panels are made up of a wooden frame with a 4mm thick transparent pane. Each panel shall have a stainless steel handle. Closets shall be equipped with two locks (top/bottom).

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Wooden casings for the classroom blackboard: They shall be made from 6cm wide, 1cm thick bevelled beech pine wood. The works include providing and installing the frames with sanding, 3 layers of paste and 3 layers of oil paint.

Chalk holders for the classroom boards: They shall be made from 10cm wide, 3cm thick bevelled beech pine wood. The holder shall be fixed on corners made from painted iron or aluminium. The price shall include procuring, installing, fixing, sanding, 3 layers of paste and 3 layers of paint. All the materials to be used in the woodworks shall be borne by the contractor, who shall obtain the supervising engineer's prior approval before procuring and installing them.

Wood general specifications:

1. The wood to be used in the woodworks shall be void of the following flaws:
 - Warped and spiral fibres, loose layers, holes caused by wood mites, wormholes, damaged layers within the undamaged ones and all kinds of mites.
 - Blue stains resulting from humidity and rot resulting from improper storage (either in terms of ventilation or being kept under the rain), soft or loose wood interior parts, and cracked wood.
 - Damaged, worn out, blackened, dissolved, dry or glue-surrounded knots
 - Other flaws like being broken, mashed, scratched or having glue pockets.

The wood to be used in the woodworks shall be beech pine wood or one of the types mentioned in the plans. It must be in conformity with the dimensions mentioned in the plans, have straight parts with not curves or warps. Any pieces that are light compared to its type shall be removed. The moisture rate in the wood to be used in exterior frames shall not exceed 12-15% and that used in interior frames 10-12%.

3. Plywood:
 - Plywood panels shall be manufactured by one of the famous manufacturers and made up of several layers of compressed wood piles glued by industrial adhesives provided that the wood fibers in each two adjacent layers shall be rotated up to 90 degrees to one another. The panels' thickness shall be as mentioned in the engineering details. The wood top sheet shall be made of one smoothly cut sheet. In case of using two sheets, linking shall be made in the middle. The top sheets shall be of harmonious colours and void of knots, wormholes, cracks, glue stains and other flaws. Each board shall have the following written on it:
 - Manufacturer/Trade Mark
 - Country of origin
 - Standard specification number
 - Classification of top and bottom
 - Type of adhesive
 - Sizes and thickness of the panels

4. Adhesives: They shall be in conformity with the Syrian standard specifications, or selected from the types listed under BS-2-1186, item 1.10.

Selection shall take into account the surrounding conditions that woodworks finishing's shall undergo.

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Adhesives shall be of the types that do not affect the natural colour of wood. These materials shall be procured in regular containers carrying the trade mark, manufacturing date and usage methods.

Providing and installing new aluminium windows or making up for missing aluminium windows parts:

Providing and installing profile aluminium windows of sections similar to the existing ones. In case of installing new windows to the entire school rooms, the section must not be less than 10.5cm, in addition to providing and installing slide windows with 6mm transparent panes with accessories (hinges, rubber seals, pulleys, etc.) according to the dimensions mentioned in the quantities tables. The contractor shall take the dimensions/sizes on site and submit a sample of the windows showing all the elements attached to get the engineer's approval prior to starting the manufacturing and installation. Moreover, the work shall include fixing marble sills and restoring the plaster around the windows, if necessary, as well as filling the spaces with silicone.

Maintaining the existing Aluminium Windows and their Accessories:

Maintaining and fixing the panes (fixing and levelling the rails and frames) and dismantling and reinstalling the windows, hinges, locks, rubber seals and pulleys using new parts, if necessary. Moreover, the work includes fixing the marble plates around the windows using cement grout in regular ratios and reinstalling the dismantled marble/stone plates using adhesives in addition to filling the spaces with silicone. The price includes all the materials required for completing the work in the optimum way in addition to providing and installing all the required materials, labour and transport costs, profits, etc. The contractor shall submit samples of all the materials to be used in the works and obtain the supervising engineer's prior approval before starting work.

General Specifications for the Aluminium Frameworks:

Materials:

- a. the aluminium sections shall be made from 6063-T5 aluminium alloy in conformity with ASTM-B221
- b. The sheets and panels shall be made from 3005 aluminium alloy in conformity with ASTM-B209
- c. the aluminium profiles and sections to be used shall be at least 1.4mm thick and in silver color, provided that all the traces of profile making shall be removed by polishing, burnishing, etc. The fittings and fasteners used (screws, nails, rivets, etc.) shall be made from aluminium, stainless steel or any other anti-corrosion substance that is compatible with aluminium.
- d. the hardware shall be made from aluminium, stainless steel or nickel-coated zinc and must be robust and of good appearance
- e. the pulleys must be made from ball bearing stainless steel with permanently-lubricated nylon frames
- f. the locks shall be security locks
- g. the weather strips shall be made from polypropylene or silicone treated pile or neoprene.
- h. the waterproof strips shall be made from PVC or vinyl
- i. the glass sheets shall be 6mm thick white transparent flawless glass. The glass sheets shall be surrounded with neiprene.

- Tests:

The mechanical specifications: the ultimate tensile strength, fracture stress, yield point and elongation of the aluminium sections must not be less than the following:

Ultimate stress $145 \sigma_u \text{ N/mm}^2$

Yield point: 105 N/mm^2

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Elongation rate: 8%

Silver colored aluminium sections shall be used after being treated and polished.

- Conditions of executing aluminium works:

- a. The contractor shall check the dimensions and the real values on the actually executed construction before the start of the aluminum works and then provide the engineer with plans for the aluminum works that will be installed and also provide samples of doors, windows, sections and all equipment, installation requirements and hardware to take approval before the start of manufacturing.
- b. The color and appearance of the aluminum surface must be silvery after processing and polishing the extruded aluminum profiles and removing the traces of casting by polishing.
- c. Care should be taken to store the aluminum parts away from the pieces of copper, iron and lead. They must be isolated from the ground and walls and therefore should be placed on a wooden sill to protect them from moisture.
- d. The doors and windows shall be manufactured according to sizes by skilled technicians who have experience in this field and in a way that ensures the proper execution of the works so that the links are strong enough to ensure the doors and windows are thickened by using internal fasteners to collect these joints in a perfect manner and ensure their resistance to water and dust, taking into account that corners are square and symmetrical sides are parallel.
- e. The shapes and details of the aluminum profiles must allow the doors and windows to be closed tightly having ducts and rails for the installation of weatherproof tapes and the like. Sliding doors and windows shall have the shutter inserted inside the rail section tightly and securely. Impermeability shall be ensured by proper closure of shutters and panels.
- f. Slabs of sliding doors and windows shall be equipped with special holes that allow good rainwater drainage to the outside.
- g. Care shall be taken when transporting and handling the aluminum doors and windows to ensure that the surface is not scratched, warped or twisted, etc. The engineer has the right to reject all works that show such defects.
- h. It is prohibited to contact the aluminum surfaces with any metal surfaces other than stainless steel, zinc plated or nickered-bronze, unless after the surfaces are treated using zinc chromate coating and one of the aluminum coating or being processed using a thick layer of alkali-resistant or using rubber ionizers.
- i. Aluminum surfaces that will have direct contact with concrete, tiles, stones, bricks, wood or other surfaces shall be treated by coating these surfaces with a thick layer of alkali-resistant bituminous coating.
- j. It is prohibited to install doors and windows before the completion of the architectural opening completely including the installation of sills, cleaning, etc. The window and door frames shall be installed accurately and securely to ensure that they are fully vertical and flat, without the use of force or any warping, curvature or twisting. Otherwise, the contractor shall remove them and replace them with new ones at his own expense.
- k. Aluminum rings, bolts and rivets shall be installed using propeller made of propylene or Rawl plugs Nylon or an equivalent. The screws must be made of aluminum or stainless steel, so that they have the required size and length sufficient to install the rings according to the consent of the Engineer. All the spaces between the aluminum rings and the architectural openings of the doors and windows shall be finished with a finisher made from an oil base or a Butyl base, such as Secomastic, Seelastic or an equivalent material, in sufficient quantities to seal the spaces. Using silicone shall be prohibited. In all cases, the use of gypsum, cement mortar or wood to fill those spaces shall be prohibited.

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- l. The contractor shall protect all works of aluminum from any damage, scratching or burning by covering them or by placing the appropriate adhesive tapes on the aluminum clips and other methods, and shall replace the pieces to which the damage is caused as a result of not complying with this condition and at its own expense.
- m. If necessary, internal reinforcements may be used for the aluminum sections. These reinforcements must be made of aluminum or stainless steel only.
- n. The glass shall be firmly anchored to the aluminum frame with a rubber seal around the glass.
- o. To install the aluminum profile: normal windows, a metal frame with a thickness of 3mm shall be used. The frame consists of two pieces: the first is fixed on the reinforced concrete with metal bolts and perforations, and the second is inserted within and then the aluminum profile is fixed using a medium separating them to prevent aluminum friction with the galvanized metal. The internal partitions are also fastened from the top in case of false ceilings using wooden trestle scaffolding, executed according to the drawings.

Maintenance of metal works (doors, windows, handrails, protection grilles, etc.):

The work involves removing the item to be maintained, cutting the damaged parts and replacing them with new ones with the installation, calibration and proper use of the item as well as replacing the damaged accessories (hinges, handles, locks, etc.) with new ones and replacing the lost ones. The work includes sanding, smoothing, removal of the bumps, rust treatment, pasting, and garnish paint with at least two layers with a foundation layer. The locks to be used shall be of ISO type or an equivalent, and the handles shall have no sharp edges. Quantities and weights shall be according to the work plan. The price includes the supply and installation of all necessary materials with the wages of labor, transportation, profits, etc. The Contractor shall provide samples of all materials to be used in the works and to obtain the supervising engineer's approval before starting work.

Providing and installing wrought iron:

Metal doors: The price includes providing and installing iron corners, squares, plates, ducts, sheets, hinges, locks, and latch locks (ISO brand or an equivalent) with the complete handle of good quality with no sharp edges. The price also includes removing the damaged doors and delivering them to the school administration. It also includes the works of sanding, smoothing, removing bumps, pasting and at least 3 layers of oil paint (silver gray color) with a foundation and anti-corrosion layer. Welding works shall be done properly in a way ensuring solidity and elegance at the same time. The quantities shall be calculated in kg or per item, according to what is mentioned in the quantities table. The price includes providing and installing all the materials required with the labor wages, transportation, profits and all that is required.

The contractor shall submit executive plans for the doors as well as sample of all the materials to be used in the works and obtain the supervising engineer's approval before starting work.

Metal windows: The same conditions mentioned in the metal doors specifications apply to metal windows. The new windows shall be similar to the old ones. Each window panel is made up of a metal frame with a 4mm thick transparent glass screen fixed with a special paste. The price includes providing and installing all the accessories, handles and locks in addition to sanding, smoothing, removing bumps, pasting and at least 3 layers of oil paint with a foundation and anti-corrosion layer. It also includes providing and installing all the materials required with the labor wages, transportation,

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profits and all that is required. The contractor shall submit executive plans for the doors as well as sample of all the materials to be used in the works and obtain the supervising engineer's approval before starting work.

Window protection grilles: The price includes providing and installing iron grilles made of 1x2cm rectangular section iron bars. An average weight per cubic meter is at least 7kg. Welding shall be done in a way ensuring solidity and elegance at the same time. The price includes removing the old grilles, if necessary, and delivering them to the school administration in addition restoring the plaster in the installation area. It, moreover, includes providing and installing sanding, smoothing, removing bumps, pasting and at least 3 layers of oil paint with a foundation and anti-corrosion layer as well as installing all the materials required with the labor wages, transportation, profits and all that is required. The contractor shall submit executive plans for the doors as well as sample of all the materials to be used in the works and obtain the supervising engineer's approval before starting work.

Protection grille with a metal frame: The price includes providing and installing 3.5x3.5cm metal corners with supporting triangles on which a metal grille with 2x2cm holes shall be fixed and welded properly. The average weight per cubic meter is 14kg. Welding shall be done in a way ensuring solidity and elegance at the same time. The price includes removing the old grilles, if necessary, and delivering them to the school administration in addition restoring the plaster in the installation area. It, moreover, includes providing and installing sanding, smoothing, removing bumps, pasting and at least 3 layers of oil paint with a foundation and anti-corrosion layer as well as installing all the materials required with the labor wages, transportation, profits and all that is required. The contractor shall submit executive plans for the doors as well as sample of all the materials to be used in the works and obtain the supervising engineer's approval before starting work.

Frameless protection grille: The price includes providing and installing a metal grille with 2.x2cm holes welded on the existing metal frames (doors, windows, etc.). The price includes providing pieces of plates and corners required for fixing as required. It also includes removing the damaged grilles and delivering them to the school administration in addition to painting the grilles with two layers of oil paint with a foundation layer. The price also includes installing all the materials required with the labor wages, transportation, profits and all that is required. The contractor shall submit executive plans for the doors as well as sample of all the materials to be used in the works and obtain the supervising engineer's approval before starting work.

Other metal works: All the other metal works mentioned in the quantities table shall be treated the same as what is mentioned in the technical specifications items. All the iron to be used in the metal works shall be brand new. No linked parts shall be used, unless approved by the supervising engineer.

Metal Works General Specifications:

Iron works:

Specifications of iron:

The iron parts must have regular surfaces void of bumps, cracks, porosity and crusts. They must, when cold cut, result in a harmonious section with being ripped or broken. All parts that get ripped by the drill, or get cracked or broken when bent or cut shall be rejected, except the works of a special importance that require types other than iron, which are mentioned in the plans or technical conditions. The iron parts, in all the regular works, shall be of the regular commercial type provided that they meet the following minimum results of tensile tests:

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Iron section type	Elasticity	Fracture	Elongation at fracture
Profile bars	24kg/mm ²	42kg/mm ²	25%
Smooth and wide plates	24kg/mm ²	42kg/mm ²	25%
Corrugated plates	20kg/mm ²	40kg/mm ²	20%

The iron parts including profiles, corners, plates and beams shall have the same values mentioned in the specifications and plans in terms of size and shape taking into account the following tolerance limits:

- The length of bars as well as the length and width of plates are allowed to be increased by 400mm. No decrease shall be allowed.
- In terms of sections, the limits shall be as follows:

Plates and profiles	Width up to 50mm: ± 1 mm Width over 50mm: $\pm 2\%$ Thickness up to 12.5mm: ± 0.5 mm
Deformed and square bars	Diameter or side up to 16mm: ± 0.3 mm Diameter or side over 16mm: ± 0.5 mm

- Differences in bars' straightness are tolerated up to 5mm alongside the bar and with surface curvatures no more than 1.5mm/m.

2. Manufacturing and installation:

2.1. Method of making plates and bars:

The plate surface shall be leveled and the bars and profiles shall be cold straightened. This shall be preferably done by a pressing machine not by hammering.

- The plates and bars shall be cut regularly with no cracks or curvature so that the adjacent parts get in full contact along the contacted areas, especially in the joints that pass stress from one piece to another. Sharp corners shall be filed when cut.
- Bars shall be bent on red flame, to be later cooled down gradually. Bent parts shall not be used in areas subject to high tensions.
- The parts surfaces shall be cleaned before being pierced, and completely leveled to ensure their full contact over each other. Then they are pierced with a special drill. The holes' diameter shall be slightly less than the required diameter. It must never exceed the required diameter. The distance between the holes must be accurately measured and done according to the plan. They must be correctly lined and in parallel with the piece edge. The tolerance limit in all the above is one millimeter.

The holes' diameter must not exceed that of the rivets by 1/20 of the diameter, and by no more of one millimeter, whichever is less.

2.2. Welding works:

- Welding works must be assigned to specialist workers with sufficient experience and skill in this kind of works. Precautions must be taken to protect people and property from the hazards resulting from welding.
- Welding rods must be made by competent factories. Each rod shall bear the factory seal and must have regular internal/external diameters along the bar. The metal shall have no rust or foreign substances. The bars must easily give a stationary electric arc. The metal to be used shall be defectless.
- The edges of the parts to be welded must be carefully cut and leveled, their surfaces clean and void of foreign materials, rust and iron powder. The parts shall be juxtaposed before starting the welding works to ensure their shapes and correct positions. Then, they are pressed very well to avoid any movement

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while welding. After every welding round, the surface shall be carefully brushed before the second round starts. The same shall be done after each stop or when connecting two welded points together. The welding rods and parts to be welded must be completely dry while work. No welding work shall be done in the rain, wind and frost.

- d. Welding must be carefully and accurately done in the shapes and thickness that the work requires provided that the welding fills all the spaces to be filled in the depth and length required and in a regular way.
- e. Welding must ensure linkage between the welded parts so that they function as one part. Therefore, precautions must be taken to avoid defects, especially:
 - 1. Welding heterogeneity owing to gas holes or metallic inclusions
 - 2. Insufficient linkage or overlapping between the original metal and the additional one so that it does not stick onto the surface or make one part together
 - 3. Irregularity of the welding surface, which often results from increasing the voltage used
 - 4. Changing the welded part, properties or resistance while being welded
- f. Tests necessary for ensuring the safety and proper execution of welding shall be carried out on welded parts, especially those subject to special tensions.

Profile iron frames:

Double-panel doors shall be used in the metal frames (doors with internal and external metal plates for the new WC facilities external doors) where the materials to be used shall have the specifications required in the abovementioned section. Moreover, the shapes and sections of the profile iron parts must be internationally approved.

The metal frames shall be made according to the designs and sizes approved. The contractor shall double-check them on the actually executed construction. The metal frame shall be welded carefully and accurately so that the linked parts look as if they were one piece. Welding traces shall be removed and filed. The space between the moving and fixed parts must not exceed 3mm before being painted.

The metal frames shall be fixed onto the building by firm metal stirrups, whose minimum number shall be as follows:

Vertical sides:

Up to 0.65m: one stirrup

From 0.65m to 1.45m: two stirrups

From 1.45m to 2.45m: three stirrups

More than 2.45m: the distance between the stirrups shall be one meter at most

Horizontal sides: The stirrups shall be of a 10x50mm/m section and 20cm long for doors, and 6x20mm and 15cm long for windows. The metal frame installation shall be either on the interior side of the wall – in which case the section side used on the frame shall be protruded – or on the the cement plaster layer or in the middle of the window, i.e. within the

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wall thickness, in which case the section side used on the frame shall be protruded off the cement plaster to show the frame along the section width and to allow the hinges to be far from the cement plaster.

Before anchoring the stirrups, the metal frame shall be positioned to adjust its straightness, verticality and horizontality. The stirrups shall be anchored with cement mortar and sprinkled with water for a period long enough to ensure their solidity. No gypsum shall be used whatsoever. Iron stirrups shall be painted with anti-corrosion paint before being installed.

After installation, the metal frame must be compatible with the adjacent building elements and have right verticality and horizontality, be easy-to-move showing no vibration or noise, waterproof when the wind speed does not exceed 20km/h and rain waterproof.

Metal requirements:

Metal doors shall have appropriate requirements installed on them, which ensure movement, solidity and firm, easy and ensured closure. The patterns and sizes of these requirements shall be in line with the works they belong to and that they receive the approval of the supervising engineer and project administration.

The metal doors shall be equipped with the following requirements:

Lock – interior doors shall have a 3-cylinder deadbolt locking on two stages with a key and a latch lock opened with the handle. The lock shall be of a brand equivalent to Yale or Union. As for the exterior doors, locks shall have cylinder deadbolts of a brand equivalent to Yale or Union.

Handle – the handle must be made of nickel-coated brass similar to the ones installed on wooden doors. It must be rectangular-shaped no less than 12cm or a knob 6cm in diameter. The handle shall have a 5cm in diameter round plate. If the lock is cylinder, the handle shall be fixed and installed from the interior and exterior, either knob-shaped or cylinder-shaped 3-4cm in diameter and no less than 30cm long, according to the pattern approved by the engineer.

Hinges – door whose height exceeds 1.8m shall have three hinges in line with the door weight and no less than 16cm long. The hinges shall be fixed on the door using electric welding.

Oil paint for metalworks:

1. The surfaces of the iron sections shall be cleaned, rust removed and lubricant residues dissolved.
2. The iron shall be rubbed with sandpaper to get the harshness required for the paint to stick to it, which is one of the most important conditions to protect iron from corrosion before being painted.
3. All the metalworks shall be painted with one layer of foundation anti-corrosion epoxy paint.
4. Metalworks shall be painted with another layer of epoxy.
5. Surfaces must be coated with paste, sanded upon drying and completing the first layer, then re-pasted and sanded until they become smooth.
6. Then, the metalworks shall be painted with two layers of oil or thermal paint in the colour required, which must be approved by the engineer.

Providing and installing transparent glass sheets or plastic:

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The work involves providing and installing transparent glass sheets in the thicknesses and places mentioned in the quantities table. The panes must be defectless with no scratches or curvatures. The price includes all that is required for installing and fastening such as nails, paste, silicone, adhesives, etc. in addition to removing the damaged glass and transferring it to the approved landfills.

Moreover, the work includes providing and installing transparent plastic sheets (polycarbonate) in the thicknesses and places mentioned in the quantities table. The sheets must have no defects, cracks or heterogeneous spaces. They must also have the appropriate elasticity. The price includes all that is required for installing and fastening such as nails, paste, silicone, adhesives, etc. in addition to removing the damaged glass/plastic and transferring it to the approved landfills.

The contractor shall submit samples enclosed with the technical specifications and obtain the engineer's approval before procuring and installing the materials.

Cleaning the WC and Drinking Facilities:

The work includes cleaning all the existing WC and drinking facilities, walls, floors, properly draining the toilets, toilet seats, sinks, faucets, mirrors, shelves, doors, ceramic and marble tiles, drinking facilities faucets and removing rust and waste. The price includes procuring and using the materials required for completing the work in the optimum way in addition to labor costs and transferring the waste and sludge to the approved landfills.

Providing a new students' drinking facility:

The works include providing and installing a new drinking facility made from 3cm thick big marble panels with bevelled edges. The marble panels must be polished and at least 70cm high. The basin base must also be made from 3cm thick marble and 27cm higher than the floor level. The basin edge shall be 3cm far from the wall. The basin must have marble partitions, 30cm away from each other and a 10cm high marble baseboard according to the attached detailed plan. The new drinking facility must have the same dimensions as the old one or in line with what is mentioned in the quantities table. The work includes connecting the facility to potable water as well as providing and installing a 3-layered 1m³ plastic drinking water tank (unless otherwise mentioned in the quantities table. See the special specs of plastic tanks). The tank must be equipped with a floater, complete fittings and ¾ inch PPR pipes, valve and required accessories, etc. in addition to providing and installing long-necked faucets, whose number shall be in line with what is mentioned in the quantities table. The faucets shall be 45cm away from each other. The tank shall be connected to the main water network after being placed in the location selected by the supervising engineer with all the materials required for anchoring it. The price shall include ensuring water drainage from the drinking facility to the nearest sewer through a 4" hole, or more, in basin's base covered with a PVC or plastic strainer and connected to a drain (in case there was no drain, a new one with a metal lid must be executed) to be connected to the sewer. The wall on which the basin shall be installed shall be tiled with Syrian-made ceramics according to the areas and heights illustrated in the attached plans and the table of quantities. The price includes demolishing and removing the old drinking facility, transferring the rubble to public landfills, levelling the surfaces and preparing them for the new facility to be installed. Moreover, the price includes providing and installing all the required materials, labor costs, profits, transport, etc. The contractor shall submit samples of all the materials to be used in the installation of the drinking facility as well as the execution and installation methods and obtaining the engineer's approval before starting the execution of work.

Ceramic and Tiling Works:

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Replacing the yards and pavements tiles: The price includes providing and installing new 25x25cm or 30x30cm tiles, or similar to the existing tiles' size, dismantling the existing tiles and paving the ground properly and laying gravel, if necessary, with 200kg/m³ cement mortar and 300kg/m³ cement grout. The contractor shall take into account the color and size of the existing tiles. Moreover, the price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc.

Executing new yards and pavements tiles: The price includes preparing the area, procuring and laying proper rubble layers with pressing and rolling them till reaching a 95% density rate, and providing, laying and pressing a layer of gravel under the tiles with at least 5cm thickness. The price includes providing 200kg/m³ cement mortar and 300kg/m³ cement grout. The price also includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc.

Replacing wall ceramic tiles: The price includes dismantling the damaged ceramic tiles, levelling and preparing the area for the new tiles and installing Syrian-made wall ceramic tiles with 300kg/m³ mortar (or using adhesives on consent of the engineer) with the grout suitable for the ceramic colour. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc.

Replacing floor ceramic tiles: The price includes dismantling the damaged ceramic tiles, levelling and preparing the area for the new tiles and installing Syrian-made anti-slip floor ceramic tiles of the same size, shape and color of the existing ones with 300kg/m³ mortar with the grout suitable for the ceramic colour. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc.

Replacing floor mosaic tiles: The price includes dismantling the damaged ceramic tiles, levelling and preparing the area for the new tiles and installing Syrian-made anti-slip floor ceramic tiles of the same size, shape and color of the existing ones with 300kg/m³ mortar with the grout suitable for the ceramic colour. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc.

Installing wall ceramic tiles on the new areas: Ceramic tiles shall be installed on the walls in two methods: executing two layers of cement render (base and finer) provided that the finer layer is appropriately done with a rough surface. Then, the ceramic tiles shall be installed using 300kg/m³. The second method is by executing three layers of cement rendering (base, finer and top) provided that the top layer's surface is roughened. Then, ceramic tiles are installed using an adhesive. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc.

Installing floor ceramic tiles in the new areas: Providing and installing Syrian-made anti-slip floor ceramic tiles after preparing and cleaning the area, then laying and levelling a layer of coarse sand followed by laying a 3-4cm thick layer of 300kg/m³ cement mortar on which the tiles shall be installed. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc.

Installing baseboards: Providing and installing mosaic or bevelled marble baseboards. The dimensions shall be according to what is mentioned in the table of quantities. Installation shall be done by laying white cement rendering followed by roughening the surface on which the baseboards shall be installed. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc.

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Spaces between the ceramic/mosaic tiles and baseboards shall be filled using grout, whose color shall be decided on consultation with the supervising engineer. Installation shall be conducted in high technical specifications taking into account the required levels and slopes. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc. The contractor shall have the engineer's approval on all the materials and execution method before procuring and installing the materials. The engineer has the right to demand testing the materials before approving them.

General Specifications – Tiling Works:

Preparing the floors and executing blockage stones:

Preparing the floors:

Before starting tiling, the floor to be tiled must be cleaned from dirt, waste, rubble and the workshop remnants. The tiles level shall be decided using wired lines. A layer of coarse sand with the required thickness is then laid and levelled very well and sprinkled with water. The floor of the entire room or area must be completely prepared before starting tiling, which must not start in part of the room while preparing the other part.

Sub-floor:

Soil floors shall be pressed and hammered. If the earth was newly backfilled, it must be immersed with water until reaching the level required. This must be done on gradual layers, each of which no more than 20cm thick. After approving the pressed soil layer, a 15cm thick blockage stone layer is laid, properly paved, hammered, roughened with stone and re-hammered.

A layer of 200kg/m³ concrete is laid over the blockage stone. The concrete surface level is determined using wired lines and the surface levels are decided by using spirit levels. The concrete thickness must be 10cm over the blockage, thus totalling 25cm.

The price includes cleaning the floor from the dirt, waste and rubble and levelling the surface by adding or removing the required soil and pressing the soil properly in addition to immersing it with water. Then, the blockage stones must be paved and levelled according to the determined thickness in addition to filling the spaces with slates. The price includes providing all required materials, stones, water, soil, tools and labor to complete the work. As for the concrete over the blockage, it is estimated in cubic meter according to the specifications mentioned in the concrete section, in addition to executing wired lines and levelling the surfaces using spirit levels according to the thickness mentioned in the details without increasing the concrete leaking into the blockage or extra thicknesses.

Ceramic Tiles:

- Floors (whether granite ceramics, single fire ceramics or wall ceramics)
- Floors made of mosaic tiles, white cement Badrousi gravel, Type 30x30/2cm, 3cm thick, with a mosaic baseboard, 12mm thick, 10cm high

1. Classification:

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- the ceramic tiles must be of the mosaic type made in plastic methods or of the fully vitrified type, rather of the matt type used for floors provided that its water absorption rate does not exceed 0.3%. As for WC floors, single fire anti-slip ceramic tiles must be used.

- Mosaic tiles: 30x30cm or 40x40cm shall have a total thickness of no less than 3cm and a top layer thickness of 9mm according to 1/1 sand and white cement rates. The bottom side shall be made from black cement according to regular ratios. Mosaic tiles and baseboards must be 30x10cm and 12mm thick. They must be polished, barnished and nickeled.

2. Quality:

a. The ceramic or mosaic tiles must be in conformity with the Syrian standard specifications.

b. The ceramic or mosaic tiles must have no defects, impurities or pores that can be noticed with the naked eye from any angle, in at least 300 lux lighting and at least 2m far.

c. The colour of the ceramic or mosaic tiles procured into the site must be in conformity with what is mentioned in the tables as well as the colours of the samples submitted to and approved by the engineer. Otherwise, the engineer has the right to ask the contractor to remove the procured quantities out of the worksite at the contractor's own expense.

d. The ceramic tiles bottom shall be striped or grained, etc. Smooth tiles are not allowed. The lines depth must not exceed 0.3mm.

3. Sizes:

The floor ceramic tiles sizes are 30x30cm or 40x40cm with a thickness no less than 10mm. Difference in lengths must not exceed $\pm 0.15\%$ and 0.005% as for thickness. The mosaic tiles sizes are 30x30cm or 40x40cm with a total thickness no less than 3cm.

4. Tests:

a. Water absorption: The water absorption rate of the fully vitrified ceramic tiles must not exceed 0.3% of its weight

b. Flexural strength: The average flexural strength of 10 samples must not be less than 6.5kn/m of the fully vitrified tiles

c. Resistance to abrasion: The abrasion rate for 4 samples must not exceed 1mm/mm for the fully vitrified tiles.

d. Thermal shock resistance: There must be no trace of fragments when testing the samples against thermal shocks

e. Chemical resistance: There must be no trace of colour change, stains, etc. when compared to the original samples

f. Warpage: Warpage must not exceed 0.5% in the sample side lengths provided that the length does not exceed 200mm. In case that side length exceeds 200mm, warpage must not exceed 1mm.

g. Curvature: Curvature must not exceed 0.75mm whether concave or convex at the edges or diameters

h. Squariness: The spaces between the tile samples and the test device must not exceed 0.5% of the sample side length adjacent to that of the device.

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5. Installation:

- a. Installation of tiles must not start before testing the tiles, having the lab results and engineer's approval
- b. The tiles colour must be identical to that of the samples submitted by the contractor and, according to which, the engineer approved their procurement.
- c. Prior to starting the installation, the final levels and slopes of the floors surfaces of all the areas to be tiled with ceramic must be determined, as is shown in the plans, provided that this is duly done with the engineer's consent.
- d. Tiles shall be installed duly by fixing lines of tiles according to the required levels. The distance between each two lines must not exceed 2m. Tiling shall be done using lines and spirit levels so that the floor and walls surfaces are perfectly level and in a variance no more than 0.5%, and according to the engineer's approval.
- e. The floor to be tiles shall be divided into linear parts of equal width provided that their width does not exceed one meter. Then, they are covered in alternation with concrete of a 3-1 ratio provided that their thickness is at least 40mm over a layer of coarse sand, if available.
- f. The tiles shall be fixed over the abovementioned concrete parts after the final setting time has passed using a cement mortar made from 3-1 cement and fine sand, provided that the thickness of the mortar under the tiles is 20-30mm.
- g. The spaces between the tiles shall be 2mm, and must be in a straight line, of equal width, in parallel in adjacent lines and orthogonal in both directions.
- h. Tiles with broken corners or blunt sides or with other defects such as different colors, stains, etc. must not be used.
- i. Breaking tiles to fill in openings is not allowed. Special tools shall be used provided that cutting (in the required measurements) shall be straight with sharp corners in conformity with what is mentioned under this item.
- j. The walls shall be installed in a way making a right angle with the floors. The spaces of the wall tiles must meet those of the floor when their sizes are in line.
- k. On completion of the installation process and the engineer's consent, the tiles shall be grouted with a cement grout of the same colour filling in all the spaces. Extra grout shall be immediately wiped.
- l. The tiles shall be covered after being grouted and treated with a layer of lime mortar or hard paper to protect it until the delivery of works when the lime mortar is peeled/ hard paper removed and the tiles are cleaned with dissolved muriatic acid than with warm water and soap.

Wall Ceramic Tiles:

1. Dimensions and colour: the wall ceramic tiles shall be 30x20cm or according to the samples and colours submitted to and approved by the project administration. Thickness shall be 9mm. The colour shall be under the consent of the engineer.
2. Execution of works:
 - a. Preparing the surfaces: To be done with 2 layers of cement plastering, according to what is mentioned in the interior cement plastering works, provided that only the base and finer layers are applied when fixing the tiles with cement mortar and roughening the finer layer with a special tool to increase solidity.
 - b. Fixing with cement mortar: Ceramic tiles shall be fixed with cement mortar:
 1. The mortar shall be made from cement and fine sand in a ratio between 3-1 and 4-1 according to the work requirements. The mixing ratios shall be decided according to the properties of the fine sand to be

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used taking into account using the least quantity of water possible that shall give the mortar the required texture with the least drying shrinkage possible.

2. Prior to starting work, samples of the required tiling types shall be carried out covering an area no less than 2m² so that the engineer tests the manufacturing level, as he/she has the right to demand improving it and replacing the technicians until meeting the level required. The sample that gains the engineer's approval shall be considered a reference for good execution.
3. During the execution of the different tiling samples, tests shall be conducted on different mixtures to make mortar and use it for fixation. The tiles shall be dismantled after one week to test their adhesion to the mortar and checking the mortar's drying shrinkage, which shall be the basis on which the engineer decides on the required mortar mixture.
4. The mortar shall be mixed either mechanically or manually on a special wooden board. Cement and fine sand shall be first thoroughly mixed until making a homogeneous mixture. Then, water is gradually added while mixing continues until having the mortar paste of the appropriate texture.
5. Water must not be added to the mortar after its preparation is completed. Mortar older than one hour must not be used.
6. When using mixtures or additions to improve the mortar's workability, impermeability or fungi resistance, make sure they do not have any negative effect on the mortar's adhesion, drying shrinkage or heat expansion properties.
7. Surfaces must be thoroughly cleaned and wetted with water to ensure they will not absorb the mortar's water when applied thereon.
8. Lines of tiles shall be duly made vertically and horizontally using the spirit levels. Vertical lines shall be at the beginning and end of the wall for distances not exceeding 2m. Horizontal lines shall be placed as follows: one at the middle of the wall, one at the bottom line and one before the top line.
9. The tiles shall be fixed by applying mortar onto the entire area of the tile bottom regularly and in a thickness no more than 1.5 of the required fixation layer. Then, the tile shall be laid in its right position and slightly knocked on so that the mortar fills in all the area underneath the tile (especially the tile's corners), taking into account that all the curvatures on the tile bottom shall be filled. The thickness of the fixing mortar under the tiles shall not be less than 6mm and not exceed 15mm at any case.
10. After installation, the ceramic tile top shall be level and vertical with regular lines. The mortar shall fill all the spaces beneath the tiles. If, when knocking on the tile, a sound of hollowness is heard, the tile must be dismantled and re-fixed again.

3. Spaces:

1. The spaces between the tiles shall be as is mentioned in the tables of quantities and plans. Otherwise, they shall be 2mm thick.
2. They shall be straight, of equal width, paralleled and orthogonal in both directions.
3. Spaces shall be finished using cement grout matching the tile color. The grout must fill the spaces completely and extra shall be wiped with a damp cloth. Special wooden tools shall be used and spaces shall be water after being grouted for 4 successive days.
4. General Conditions:
 - a. Tiles must not be installed before being tested in the lab and approved by the engineer
 - b. Tiles procured to the worksite shall be identical to the samples approved by the engineer

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- c. Tiles must never be broken to fill in openings or be placed around holes and pipes. Instead, special cutters must be used to give exact sizes, proper cutting, whether straight or round as is required, without causing any cracks or fractures.
- d. Tiling shall be carried out by skilled experts. The engineer has the right to demand that the contractor replace them if they prove to be unqualified enough.
- e. On completion of tiling and grouting, the surface shall be thoroughly washed and cleaned using warm water and soap.

4. Expansion Joints:

- a. Tiling shall having expansion joints extending over 5m in both directions
- b. The expansion joints shall extend down the base layer beneath the tiles. Canes shall be used to make these joints.
- c. The expansion joints' width shall be between 6mm and 10mm, according to the engineer's instructions.
- d. Tiles expansion joints must not meet other joints in the wall. However, other joints may be used for specific purposes.

13. Cement and Brick Blocks Works:

- a. Providing and installing regular blocks of different thicknesses. The blocks must be made from 200kg/m³ regular concrete with a breaking resistance no less than 60kg/cm² after 28 days. The blocks to be used must have distortions.
- b. The blocks shall be installed using 300kg/m³ cement mortar. While being executed, the surfaces' levels and verticality must be carefully done in addition to having spaces between the blocks of at least 1.5cm (after pressing the blocks on them). Moreover, a metal net shall be placed between the block barriers inside the mortar (every three barriers). The metal net shall weigh 600g/m² and has a width less than the block by 2cm on each end. In case the blocks are built next to a concrete column or wall, the concrete surface must be roughened at the connection area with the block and the metal net shall extend in a right angle to the end of the block barrier at 20cm from the concrete surface end. It shall be fixed on the concrete surface using steel nails. The blocks shall be sprinkled with potable water at least twice a day for three days. Sprinkling with water must start 12 hours after the completion of building the block at most. No breaking in the block shall be allowed before the watering period is over. Before starting the building works, the area and surfaces must be thoroughly cleaned and washed and the blocks must be wetted to remove dust and lessen their absorption of the mortar's water. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc. The contractor shall have the engineer's approval on all the materials and execution method before procuring and installing the materials. The engineer has the right to demand testing the materials before approving them.

General specifications for the blocks to be used:

Regular and hollow cement blocks are made from concrete of 200kg cement per 1m³ of sand and gravel mixture whose granules must not exceed 10mm in size. The mixture shall be as follows:

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300 litters of fine sand

300 litters of coarse sand

400 litters of gravel

The water ratio shall be suitable for keeping the concrete tight. The block ingredients are subject to the same conditions applied to the concrete works.

The dimensions of the typical blocks to be used in building the new WC's and other areas must be 20x40cm and 10-20cm thick, as required.

The blocks surfaces must be level with right angles and have no warpage. Hollow blocks are made in strong regular-shaped iron moulds and are pressed very well. Then, they are kept away from sun shine and are constantly watered for 15 days. Samples of the prepared blocks shall be sent to the lab to test them against pressure. The results must not be less than the following limits, after deducting the spaces and calculating the net section:

	After 7 days	After 28 days
Regular blocks	40kg/cm ²	60kg/cm ²
Hollow blocks	35kg/cm ²	50kg/cm ²

- Mortar:

a. River sand or fine crushed sand passing through 2mm-holed sifter, and only 30% of it pass through a 0.2mm-holed sifter, shall be used in the mortar for all kinds of building. Otherwise, all the materials used in making the mortar, i.e. cement, sand and water in addition to the mixing method shall be subject to the same conditions applied to the concrete works.

b. The mortar ratio must be 300kg of cement per 1m³ of sand

c. The mortar must be kept away from sun shine during work

- Brick blocks: Providing and installing brick blocks of different thicknesses with a breaking resistance no less than 120kg/cm² taking into account all the conditions of the installation method and materials used that mentioned under the installation of cement blocks.

14. The works of 3 layers of regular cement render in preparation for the paint: The render consists of fine crushed stone sand whose diameter ranges between 0-3mm in addition to Portland cement and water. The sand must be clean and void of waste and organic substances. The water must be potable. The render shall be executed on three layers: The first is a base layer consisting of 1:1 sand and cement mixture and water; the second a finer layer made up of 250kg/m³ cement; and the third a top layer made up of 350kg/m³. The overall render thickness must be about 2.5cm. The render shall be executed as follows:

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First, smooth surfaces shall be roughened by pricking. Then, the spaces resulting from sanitary and electrical works, etc. shall be filled with 350kg/m³ cement mixture. In case the walls and ceilings' surfaces had protrusions or dents, redressing them shall be done with 350kg/m³ mortar. If the dents were more than 5cm thick, the mortar shall be laid in layers with at least one day separating each one to prevent cracks in the cement layer. In all cases, a 600g/m² metal net shall be installed in the areas of filling the spaces and dents as well as in the areas where the blocks meet the concrete or in any other area where two different materials meet. The net shall cover the whole area extending 5cm from all the space sides. The net shall not be installed until after filling the space to the surrounding surface level. In corners subject to shocks, a protection corner with a net up to 200cm high from the final floor level must be installed. The corner width shall be at least 5cm. When preparing the base layer, Polybond adhesives must be mixed with the cement and sand in the ratios recommended in the material bulletin. The contractor must submit a sample of this material with its specs bulletin to be approved by the engineer before procuring and using it.

Prior to starting each of the render layers, it is important to remove all traces of pricking and wash the surfaces completely. After applying the base layer, it must be left for at least 2 days while being watered before starting the following layer. Afterwards, lines shall be made on the surfaces to ensure the render being level. Then, the finer layer shall be applied and levelled, then left coarse enough to have the third top layer, which must be level, smooth and ready for the paint works. The second layer must be watered for two days at least before the third layer is applied. As for the third layer, it must be watered for at least three days, then left for 28 days at least until dull drying before the paint works start. In all cases, watering must be conducted twice at least twice a day, in the morning and evening. It is not allowed to start any stage of the render works before having the engineer's approval.

Two layers of regular rendering before laying the ceramic tiles and white external rendering: All the conditions mentioned above in (a) shall be applied except the one about the third layer (top layer)

White external rendering: The external rendering consists of 500kg/m³ white cement and is executed on two stages at least to have the thickness and shape required, according to the engineer's consent.

Coloured external rendering: All the conditions mentioned above in (a) shall be applied with the addition of colourants. Samples of different colours shall be submitted for approval before being executed. It is possible to submit and use ready-made coloured rendering on the engineer's consent.

The water to be used in all the rendering works must be clean and potable. The contractor shall use sifters to clean the sand from big granules. The surfaces must be thoroughly cleaned from wood fragments, nails, etc. before starting any of the rendering works.

All kinds of frames (wooden, iron, marble, etc.) must be installed before starting the rendering works.

Rendering works must not start before completing all the plumbing and wiring works. The price includes providing and installing all the required materials, cost labour, transferring rubble to the approved landfills, profits, transport, etc. The contractor shall obtain the engineer's approval on all the materials and execution method before procuring and installing them. The engineer has the right to demand testing the materials before approving them.

General specifications of the materials used in cement render:

Sand – The sand to be used in the cement rendering works must be river sand or fine crushed quarry stone sand, and must be in conformity with the relevant conditions for the sand used in concrete works. As for granular composition, the

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sand granules must be between 0-3mm provided that fine granules (less than 0.8mm) rate must be 15%-30% and that the granules of the sand used in the fine top layer are 0-1mm.

Regular cement – It must have the following specifications, noting that the recently procured cement must not be used until a few days later where it is kept away from dampness.

The cement used in regular concrete works shall be industrial Portland cement with the following chemical specs:

So3 ratio: not more than 3%

Mgo ratio: not more than 5%

Alumin ratio: not more than 10%

S90 ratio: not more than 2%

The cement must be so fine that it passes through a 324-hole sifter/ 1% per cm²

15. Paint Works

They include all the paint works applied to cement, wooden, metal and other surfaces. The work includes removing the school furniture before starting painting and returning them on completion of the works, provided that the furniture must be preserved from any damages that may occur.

Paint: The contractor shall properly clean and remove all the paint stains off the floors and other surfaces and deliver the worksite clean on completion of work. The different paint colours shall be decided in cooperation with the school administration and the UNDP-appointed engineer.

Water matt or oil paint for cement walls and ceilings:

In case they were already painted, the first stage is removing the old paint and sanding the surfaces. On completion, the surfaces shall be cleaned from the dust using a fine broom or wet cloth. Once the surfaces are clean and completely dry, paste shall be applied to fill in the cracks and spaces and level the surfaces (dents) and treat the areas around the existing holes (electric boxes, around chimney's, doors and windows frames, etc.) with the appropriate materials. After the paste has dried, it shall be sanded and smoothened again, then cleaned. Afterwards, a foundation layer suitable for the type of paint shall be applied. Once dry, pasting shall be applied where needed followed by two layers of paint. After each layer of paint, pasting and sanding are carried out to completely fill in the cracks.

Water matt or oil paint for new cement walls and ceilings (not previously painted): The first stage is checking the surface to be painted and ensuring it is defect lessness. In case there are no architectural or constructional defects to be treated, the surfaces must be completely dry and were executed at least 28 days ago. After ensuring the surfaces readiness for paint works, they must be cleaned with a metal brush to remove all the concrete, cement and other protrusions and clean the surfaces from all the greasy materials. After that, the surface shall be smoothened then painted according to the stages illustrated in (a).

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Oil paint on the already painted wood surfaces: The first stage is removing the old paint layers either by burning or using chemical solvents (trisodium phosphate). On completely removing the old paint, the wood surfaces shall be thoroughly cleaned and smoothened. Pasting shall be executed and applied to the whole wooden surfaces to fill in the spaces, holes and cracks. Once dry, the paste shall be sanded and the wood dusted. Afterwards, a foundation layer of wood paint is applied, left until dry then sanded to remove any possible protrusions. Another layer of paste is then applied and sanded once dry. There might a need to re-apply the foundation layer, based on the engineer's opinion. On completion of pasting and sanding, the first layer of paint shall be applied to the wood and left until it dries. In case some defects appeared, pasting and sanding shall be repeated until meeting the required level of quality. Finally, the second layer of paint is applied until full covering.

Oil paint for the new wooden surfaces: The same stages mentioned above shall be applied except removing the old paint.

Oil paint for the previously painted metalworks: First, the old paint shall be removed by burning or using chemical solvents. Then, sanding, smoothening and removing the protrusions and rusty layers shall be carried out followed by a thorough cleaning of the surfaces from dirt and dust. Next, the first layer of paint is applied and left until it dries. Areas that need re-sanding and pasting shall be checked. After that, another layer of paint is applied until full covering.

Oil paint for the new metalworks: Surfaces shall be sanded and smoothened followed by a layer of anti-corrosion paint. Then, spaces shall be filled in with paste followed with sanding once it has dried. After a thorough cleaning, surfaces shall be painted with a foundation layer followed with three layers of oil paint, each of which shall be applied after the complete drying of the previous one.

Painting the classrooms boards: Painting cement surfaces specifications shall be applied taking into account the importance of sanding, smoothening, 3 layers of pasting, 3 layers of paint and that the paint must be dry

The contractor shall execute samples for the different paint colours (walls, wooden and metal doors, etc.) and obtain the approval of the school administration and the engineer appointed by the Organization before starting work. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc. The contractor shall have the engineer's approval on all the materials and execution method before procuring and installing the materials. The engineer has the right to demand testing the materials before approving them. Prior to starting any kind or colour of the paint works, the contractor shall prepare the samples required for approval, which shall not be paid for as their price is included in the paint price.

General specifications of the materials used in the paint works:

- The approved brands are Hempel, BMB, Cristina Plus or an equivalent
- The paste to be used in oil paint works is made from pure flax oil, speedage (calcium carbonate) and zinc with the addition of colourants, if necessary. The oil shall be Syrian made or of an equivalent brand. The linseed oil must be original and free of other oils, acids and other additions. If a thin layer is applied to a glass sheet, it must dry and made an elastic solid crust within 96 hours.
Speedage is pure limestone powder. The best type is extracted from white marble powder.
- Procuring and storing paint materials:

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Paint materials shall be procured into the workshop within their original wraps, undamaged, and that their trademarks and factory instructions are clearly labelled.

In the workshops where paint works require, the contractor shall make a separate warehouse for the paint materials, based on the administration's request. The warehouse shall be under the supervision of the contractor and administration caretaker whose presence is essential to open the warehouse.

Prior to admitting them into the warehouse, the materials shall be presented to the administration representative to record them in a special file. Moreover, taking materials out of the warehouse for daily consumption must be in presence of the admin representative who shall record that in file signed by the contractor or his representative.

5. Executing paint works:

- a. Paint works shall not start until completing the other finishing works that may damage paint or hinder its execution properly. The approval of the supervising engineer or admin representative to carry out paint work in any section shall be obtained. Architectural elements of the school must be protected before starting paint works by covering them with newspapers or adhesive paper. The already painted walls shall be sanded to remove all protrusions, stains and dirt's and perfectly level the walls surface. Then the result dust shall be removed.
- b. After checking the surfaces dryness and having no dust, pasting the cracks, sanding the paste and repasting until fully filling in the spaces shall be carried out.
- c. It is imperative not to apply a new layer of paint until the previous one has completely dried.
- d. Executing paint layers shall continue until fully covering the surfaces to be painted and according to the engineer's approval.
- e. The contractor shall repair the paint around wiring, foundations and installations and carry out the required welding's accurately and carefully.
- f. The final layer shall not be applied before completing all the other finishing works.
- g. On completion of the paint works, the contractor shall, at his own expense, ensure cleaning the windows, metalworks, sanitary and electrical equipment and floors from the traces of paint and all other residues resulting from paint works.
- h. Paint shall be executed in the colours specified in the works tables. The engineer's approval on colours shall be obtained before starting the paint works.
- i. The engineer has the right to demand executing a separating coloured line between two colours or paint types in the appropriate width. This line shall be considered included in the dry paint price.
- j. The engineer has the right to call off or put off all types of paint works, partially or wholly, to which the contractor has no right to object or claim compensation.
- k. All the materials to be used shall be valid and kept packed in dry placed.
- l. All the materials used in the paint works shall be available in the local market, e.g. Hempel, Umayya, or an equivalent.

16. Mural decorations in corridors and classrooms:

Providing and executing mural decorations in the corridors, classrooms and where the engineer sees appropriate according to the numbers shown the table of quantities and in the required sizes. The drawings shall be executed with oil colouring materials. The shapes and contents of the drawings selection is to be approved by the engineer and school

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administration. The contractor shall submit samples of the materials to be used to the engineer for approval. Also, he shall submit a 1:10 paper plan showing the dimensions, colours and their degrees before executing the drawings.

17. Shades brick tiles works:

Providing and installing brick tiles for the shades and in the areas the engineers finds appropriate. The tiles shall be Syrian-made, solid, hard, defectless, with a minimum water absorption rate, with fixed colours and similar to the existing tiles around the place in size and colour.

Prior to starting the works, the contractor shall submit detailed executive plans and obtain the engineer's approval on them as well as the materials to be used in the works. Samples of all the materials must be submitted.

18. Expansion Joints Works:

Maintaining the expansion joint shall start with removing the damaged aluminium cover, if found, and restoring the render around and inside the joint (according to the same cement specs, item 14). After that, an aluminium cover, at least 15cm wide and 1.6mm thick, shall be provided and installed. The cover surface must be anti-slip. Upon ensuring the joint's readiness and cleanliness, installation takes place by fixing the cover at one end using stainless steel bolts, then is left free. After that, the space between the cover and surface shall be filled in with silicone. Before starting the works, the contractor shall have the engineer's execution method and approval on all the materials to be used in the works.

19. Roof insulation works, maintaining the existing insulation and providing and executing a new insulation system:

Maintaining the existing insulation: The work includes replacing the damaged areas of the existing insulation layers with new ones of the same existing system. The damaged layer shall be accurately removed. The area shall be thoroughly cleaned and all the dirt and waste removed. Once completely dried, new insulation layers shall be installed taking into account the sticking of the new layer with the surrounding one. Chamfering the concrete sides with the insulation layers: This shall take place in the insulated roofs without chamfering the corners. It shall be executed at the adjoining area between the horizontal surfaces with the vertical elements (walls, chimneys or parapets). It is a prism section with a right-angled isosceles triangle base whose sides' length is 15x15cm. Before executing the chamfer, the external rendering and plaster shall be cut at 15cm from the surface and 1.5cm deep at least. Hollows in the blocks, if any, shall be filled with 300kg/m³ cement mortar. The area shall be cleaned from dirt and waste and dust shall be removed without using a lot of water to avoid its leakage beneath the existing insulation layer. Once ready, the chamfer shall be executed in the specified dimensions using a concrete mixture made from fine gravel, no less than 5mm in diameter, and sand and 300kg/m³ cement reinforced with a chain link net. Expansion joints shall be executed alongside the chamfer with a 3m distance between each two joints. The chamfer's top side must perfectly go through the area where the external rendering and plaster were cut. Moreover, the chamfer's sloping surface must be perfectly level. All spaces between the chamfer's top side and the plaster on the vertical surface shall be filled in with cement mortar of the same ratio. The chamfer shall be watered for three days, at least twice a day, while being covered with gunny. Then, it shall be left to dry completely. After that, it is painted with two layers of liquid bitumen, at least 1mm thick, and the expansion joints are filled with an appropriate elastic material.

Providing and executing a complete new insulation system: The work includes removing all the existing insulation layers and filling in the cracks and spaces properly after having the engineer's approval. After that, the place shall be

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thoroughly cleaned, gutters prepared and spaces filled with mortar. A 7cm thick slope shall be made from 300kg/m³ concrete reinforced with a chain link net. The slope shall be divided into areas sloping towards the gutters. The slope surface shall be smooth, level and perfectly polished. 1cm expansion joints shall be executed deep down the slope with 3m distances between each two joints in both directions. The slope shall be completely covered with gunny and watered twice a day for seven days at least. A chamfer shall be executed on the insulated walls, without chamfering the corners, at the convergence points of the horizontal surfaces and vertical elements (walls, chimneys or parapets). It is a prism section with a right-angled isosceles triangle base whose sides' length is 15x15cm. Before executing the chamfer, the external rendering and plaster shall be cut at 15cm from the surface and 1.5cm deep at least. Hollows in the blocks, if any, shall be filled with 300kg/m³ cement mortar. The area shall be cleaned from dirt and waste and dust shall be removed without using a lot of water to avoid its leakage beneath the existing insulation layer. Once ready, the chamfer shall be executed in the specified dimensions using a concrete mixture made from fine gravel, no less than 5mm in diameter, and sand and 300kg/m³ cement reinforced with a chain link net. Expansion joints shall be executed alongside the chamfer with a 3m distance between each two joints. The chamfer's top side must perfectly go through the area where the external rendering and plaster were cut. Moreover, the chamfer's sloping surface must be perfectly level. All spaces between the chamfer's top side and the plaster on the vertical surface shall be filled in with cement mortar of the same ratio. The chamfer shall be watered for three days, at least twice a day, while being covered with gunny. Then, it shall be left to dry completely. After that, it is painted with two layers of liquid bitumen, at least 1mm thick, and the expansion joints are filled with an appropriate elastic material. Granuled bitumen sheets are then laid over each other by 10cm. At the end of the roll by at least 15cm the roll shall be heated by flame. All the insulated surfaces shall be checked for proper insulation by firmly closing the roof gutters drains and immersing the area with water for 24 hours. In case water leaked, the contractor must carry out the required maintenance at the leaking areas or repaint the whole roof, according to the engineer's instructions. The price includes providing and installing all the materials required, labor costs, transferring the rubble to the approved landfills, profits, transport, etc. The contractor shall have the engineer's approval on all the materials and execution method before procuring and installing the materials. The engineer has the right to demand testing the materials before approving them.

20. Marble and stone works:

Marble: Marble tiles shall be used in the floors, stairs, windows and doors frames, the kitchen sink board, drinking facility and other areas, according to what is mentioned in the plans and table of quantities. Marble shall come in the required thicknesses, void of dirt, foreign substances, cracks and fractures, very well polished, with a minimum of water absorption and homogeneous in colour. Bevels shall be executed where required. Marble shall be installed according to the sizes required using whole pieces. It is not allowed to use small pieces connected to each other unless the engineers says otherwise. Marbles shall be installed using 350kg/m³ cement mortar of a colour suitable for that of the marble. Spaces between the marble tiles shall be filled with anti-shrinkage insulative grout of a colour suitable for that of the marble, to be selected by the engineer.

21. Regular and reinforced concrete works:

This item includes providing and executing all the regular and reinforced concrete works, precautionary measures and maintaining the executed concrete in addition to the specifications of the different materials used in these works. The contractor shall be responsible for all the constructional works and their conformity with the architectural, mechanical, electrical and sanitary plans. Any error resulting from disconformity shall be the contractor's responsibility and must be redressed at his own expense within the contractual period. Moreover, the contractor shall coordinate between

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concrete works and the other works in terms of placing pipes and leaving holes within the concrete where needed in addition to other things necessary for executing the works very well according to the specifications and engineer's instructions.

Concrete shall be procured from approved plants under the engineer's consent. In case of small quantities (less than 5m^3) or if ready-made concrete could not be used, or according to the work demands, concrete shall be prepared on site. The contractor shall be responsible for providing the mixer, labour and mixing materials. Moreover, concrete shall be, in all cases, subject to testing according to the Syrian Arab Code. Poured concrete shall be treated and wetted with clean potable water for at least 7 days from the date of pouring, or according to the engineer's instructions. Further, poured concrete shall be covered with gunny of a water-wetted 2.5cm thick layer of sand. The administration has the right to ask the contractor to carry out polishing the poured concrete according to work necessities where cement is laid on the concrete surface by 1.5kg per square meter and then is polished very well. The concrete polishing works shall be included in the concrete works and the contractor shall have no right to demand any addition payment for polishing works. It is the contractor's responsibility to carry out all the tests demanded by the engineer at the former's expense, especially the tests of compression strength and workability of concrete.

Wooden moulds and coverage works: The wood to be used in coverage shall be new and have level surfaces ensuring the correct design and shape of the constructional elements upon pouring concrete as well as level concrete surfaces void of warping, curvature and distortion. The moulds must have no waste or traces of concrete before being installed and used. Moreover, they must be so robust and firm to tolerate the pressure and weight of soft concrete while pouring without having any undesired distortions. Furthermore, measures aiming at preventing the leakage of water and cement mortar from the wooden mould while pouring concrete shall be taken. The wooden moulds shall be dismantled on completion of pouring according to the conditions of the Syrian Arab Code.

The specifications of the materials used in concrete:

Cement:

1. The cement to be used in concrete works shall be Portland cement made by approved plants and come from a source approved by the engineer.
2. Resistance: the results of testing samples of 1/3 cement mortar must not be less than the following (estimated by kg/cm^2)

Stress	After 7 days	After 28 days
Tensile	20kg/cm^2	25kg/cm^2
Compressive	250kg/cm^2	315kg/cm^2

3. Cement shall be procured into the workshop in firmly sealed paper bags and in good condition. Each bag shall have the manufacturer's name, trade mark, type of cement, and weight (50kg) with a maximum tolerance rate of 2%. Bags exceeding this rate shall be rejected. In certain special cases approved by the administration, cement may be procured in barrels or other packing methods.
4. The administration has the right to send samples of the procured cement to a lab of their choice to verify its compliance with the required conditions, at the contractor's expense. The administration may accept or reject all the procured quantities based on the test results, with the possibility to re-run the tests, if found necessary, and reject the quantities again in case of their non-compliance with the conditions.
5. Cement shall be stored in roofed, moisture-resistant warehouses ground insulated by wooden racks or any other moisture-resistant material. It shall be kept at least 20cm higher than the ground level. Old batches shall

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be used before new ones provided that usage takes place between 7-45 days from the manufacturing date, as newly-manufactured cement solidifies slowly given the high rate of lime it has, in addition to the fact that long-stored cement has less resistance.

6. Any bag that is damp or damaged by dampness (having lumps) shall be rejected, according to the supervising engineer's opinion. Moreover, only one type of cement shall be used in one whole part of the work.
7. Anti-sulphate cement shall be used in all the concrete works in contact with soil.

Sand and Gravel:

The sand and gravel mixture has an enormous effect on the specifications and resistance of concrete used in the preparation of the mixture. Therefore, the mixture's elements shall be carefully selected in terms of their compliance with the required conditions, i.e. type, cleanliness and composition.

- Type: In regular and reinforced concrete, a sand and gravel mixture of the following types is used:
 1. Soft materials (sand): substances passing through size 4 sifters with 4.76mm holes. In the manufacturing of concrete, soft materials originating from natural sources are used such as rivers and seas or sand resulting from crushing hard stones except basalt.
 2. Rough materials (gravel): they consist of natural gravel or gravel resulting from crushing hard stones at quarries, provided that the stones are hard, weathering-proof and that the granules are closer to having spherical or cubic shapes with no high rate of thin granules.
- Cleanliness: gravel and sand must be clean and void of any substance that may lessen the concrete's solidity or badly affect the reinforcement iron, particularly, having no cavities, soft spots, parasitic lines, organic substances, adhesives and foreign substances such as pieces of coal, wood and Sulphur and gypsum substances. Moreover, having fine dust on gravel shall prevent the adhesion of cement. Therefore, gravel shall be washed with water to get rid of the dust particles and clay. In case sea sand is used, it shall be washed with water to get rid of salts.
- Gravel shall meet the following requirements:
 - A maximum rate of 28% of abrasion (Los Angeles experiment)
 - A maximum rate of 15% of small or flat pieces
- Granular composition: The mixture of gravel and sand as it is procured from nature or quarry shall not be allowed. Gravel shall be separated into two types at least – fine and hard. The engineer has the right to demand supplying the hard materials and gravel in separate parts. Sand granules and gravel shall be graded in the rates making the minimum spaces between granules, i.e. density shall be at its maximal limit. To ensure that, samples of sand and gravel are taken and sifted according to the British or French specifications to get the different elements comprising them in terms of grains sizes. A gradation line chart is drawn and compared to the typical one. If it shows a big difference, granular composition shall be modified by increasing some of the missing elements or decreasing the extra elements until reaching the best gradation. Samples of concrete mixtures shall be executed according to rates specified by the engineer and modified as required until reaching the best mixture to give concrete with maximal resistance and density.

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Water:

The water used in making concrete, mortar or sprinkling and wetting concrete must be pure potable water. It must have no harmful quantities of oil, alkali and salts. Any other source of water shall not be allowed unless after testing samples of it in the lab to verify it is void of any substances harmful to concrete, especially organic substances. This shall be done by consent of the supervising engineer.

Reinforcement steel:

- a. Deformed reinforcement steel used in reinforcing floors (under the tiles in some of the schools to be re-tiled), 8mm in diameter:
 - Elasticity point: not less than 24kg/mm^2
 - Breaking point: not less than 24kg/mm^2
 - Minimal elongation at breaking point: not less than 20%
- b. The reinforcement steel used in roof concrete of the WC rooms shall be one lower net 6 T 10/m with similar upper ones. As for the WC rooms' floor, two 6T 10/m upper and lower reinforcement nets shall be used.
 - Elasticity point: not less than 36kg/mm^2
 - Breaking point: not less than 50kg/mm^2
 - Minimal elongation percentage: not less than 10%
- c. Prior to starting work, the contractor shall submit the factory's testing certificate for each shipment of the reinforcement steel bars including all the physical and chemical steel conditions and test results.
- d. The supervising engineer has the right to demand testing samples of the steel in an approved lab to verify its compliance with the certificates attached to it. The contractor shall bear the cost of those tests.
- e. All the reinforcement steel bars must have no waste, severe rust, paint, grease or any other harmful materials. The contractor shall remove all the waste, crust and severe corrosion, if any.

Concrete Ratios:

This term refers to the weight of cement per one cubic meter of poured concrete.

- a. Specifying the quantity of each type of sand and gravel as well as the quantity of water used in the manufacturing of one cubic meter of concrete must be carefully considered. The essential condition to have highly strong, resistant, durable concrete is the high density of concrete where spaces are the least possible.
- b. Sand and gravel ratios shall be specified based on lab tests, whether the contractor's lab, the workshop or any lab chosen by the administration, where samples of the sand and gravel to be used shall be tested. Prior to pouring concrete, the contractor shall provide quantities of the types of the sand and gravel to be used, provided that each quantity is not less than a truck full load. Samples shall be taken from the top, middle and bottom of the pile, to be sifted in typical lab sifters. The result shall be organized in tables or line charts and the final rates of the final mixture shall be compared to the typical line charts and tables, in addition to the water ratio to cement. Concrete types shall be made according to the decided rates. The types shall be compression tested after 7 days and 28 days. In case the results passed the minimum limits, the rates shall be approved and considered as long as the quality of the materials procured into the workshop has not changed. If not, tests shall be carried out again. It is noteworthy that the types of tested sand and gravel shall have their ratios separately, and that under no circumstances shall the types be mixed then had their ratios as a whole.

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- c. The ratio of water in concrete shall be according to the required degrees to allow the concrete to go through the mould's corners and coat the steel bars without any leakage or surfacing of water. The degree of concrete viscosity is determined by Abrams' Cone test according to the Syrian Arab Code. The concrete resistance must be $F'C=200\text{kg/cm}^2$.

Tests: The contractor shall, at his own expense, run the tests required for concrete works according to the supervising engineer's instructions and the Syrian Arab Code.

22. The Works of repairing the Constructional Elements Damages:

Damages to the constructional elements refer to the openings and damages to concrete and reinforcement steel in tiles, columns, beams and walls. Their restoration refers to restoring the constructional element in the damaged area to its original state. The following shall be taken into account when carrying out the restoration works and ensure the elements' safe use.

The elements:

- Prior to starting work, a report proving the constructional safety by approved competent parties shall be obtained and submitted to the supervising engineer for approval and working according to the report recommendations.
- Before starting work, the contractor shall obtain the engineer's approval on the method, working stages, vehicles, equipment and materials to be used.
- Working in accordance with the Syrian Arab Code conditions for steel connection works
- Using additional materials to the concrete mixtures in areas of openings in the concrete elements to lessen concrete shrinkage
- Supporting the areas adjacent to the repaired area, if necessary
- Using special materials to making the new concrete stick to the old one
- Cleaning the reinforcement steel very well before pouring concrete
- Taking all the occupational safety precautions on site and during work
- Following the instructions of the supervising engineer

25. Excavation and backfilling Works:

Excavation works may be executed under the foundations, bases and the required areas in mechanical methods. Work shall be done according to the measurement and shapes specified in the plans and as required, taking into account pumping out groundwater, if any, according to the engineer's instructions to ensure the soil solidity. In case mechanical methods are used, a layer of 10cm deep shall be left for manual digging to ensure the soil solidity under the foundations. The contractor shall take all required measures to use the soil resulting from the excavations; some amounts to be used in backfilling shall be placed aside and the rest to be used in backfilling other areas within the project. The surplus, or non-usable quantities, shall be transferred outside the worksite according to the engineer's instructions. Excavations shall be executed in the required level, without any increase. In case they exceeded the level required, the contractor shall redress the mistake in the method decided by the supervising engineer.

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The soil used for backfilling shall have no rubble, dirt and foreign materials such as waste, ashes, wood, leaves, etc. In addition, mud and clay must not be used. In case the results of digging, or part of it, can be used in backfilling, only the usable part may be used. If insufficient, the contractor shall commit to procure backfilling usable materials, at his expense, after having the engineer's approval. Backfilling shall take place around the foundations and for leveling purposes, laid in layers not exceeding 25cm thick, and sprinkled with water to be mechanically or manually pressed, as the engineer instructs. Pressing must be good enough to make a dry density rate of 95% of the maximal density determined by the lab, when tested according to Proctor modified test. The contractor shall break all the old bases and floors that appear during the excavation process and remove the resulting quantities. Moreover, the contractor shall not start pouring the foundation concrete or laying the services pipes, etc. before the engineer verifies the executed excavations and authorizes the beginning of the works. In case of exceeding the planned foundation excavations, either by mistake or as a result of collapses, the contractor shall fill back the extra depths with regular concrete along the entire width of the foundations, as is shown in the plans. As for extra horizontal dimensions in the foundations width, they may be backfilled with soil materials pressed in layers according to the specifications after the foundations have been poured. The contractor shall not demand any surcharge for doing so. Furthermore, the contractor shall be responsible for supporting the excavations sides to prevent their collapse and protect the workers and works alike. No extra surcharge shall be paid in return for this.

The contractor shall cooperate and coordinate his work with the competent authorities to facilitate the traffic while carrying out the excavation work, with the necessary detours on the roads, his own expense, and in agreement with these authorities. Pathways should be erected through the open ditches for pedestrian traffic. The road must be kept open from one side of the work course. A straight and unhindered walkway must be maintained. The contractor is required to provide the necessary protection for pedestrians and vehicles in excavation sites by placing adequate and appropriate barriers with setting lights at night according to the administration's instructions. The contractor shall bear all costs to maintain safety in the streets and roads within the excavation sector as well as the safety of all safety equipment, barriers, pathways and crossings over the ditches.

All works and items mentioned in the Table of Quantities or in the plans, whose execution requires digging and backfilling, shall be priced with all the necessary machinery, equipment, materials, labor, transfer, etc. and included in the price under the same item.

26. Demolition and Removal Works:

Prior to starting the demolition works, a written note between the supervising body and the contractor shall be prepared in which all the undamaged materials resulting from the demolition works shall be listed. The contractor shall store these materials on site. Coordination shall be made between the works that are executed on site and the required demolition works. The contractor shall inspect the structures to be demolished prior to the commencement of the demolition work and take all precautions to preserve the parts that are scheduled to remain intact (the contractor shall be responsible for the parts that are damaged during the demolition and shall repair them at his expense). The contractor shall support all the bearing parts appropriately if the demolition will change the nature of the load, or if the load is increased for temporary or permanent purposes.

The area surrounding the demolitions should not be affected as much as possible. If the demolition works prove to be harmful to the surrounding buildings, the contractor, in conjunction with the supervising authority and the owner of these buildings, must estimate their current situation. If necessary, the contractor shall take the appropriate measures

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before starting the demolition works. All debris, rubble and other materials resulting from the (non-usable) demolitions must be removed from the site. The contractor must comply with the safety conditions approved in the demolition and removal cases after having the supervising engineer's approval.

The construction of barriers, warning lighting and the necessary means of protection and safety of pedestrians and workers, especially during the night, must be carried out. The demolition of any upper wall must be carried out only by means of individual protection using a safety belt, or by an appropriate collective protection means to avoid possible falls, during the demolition. Care must be taken when using equipment and removing debris to avoid any damage caused by demolition, removal, or equipment failure. Workers must be provided with individual protective equipment such as "protective suits, helmets, gloves, goggles, safety shoes, masks, safety kits, breathing masks, safety cords, suspension hooks and ear protectors. Dust must be avoided by sprinkling water over the rubble.

27. Cleaning the site and waste removal works:

Where there is a special item on cleaning the site, the work shall include the collection of debris, rubble and waste currently existing in the building and before the start of any work in the classrooms, corridors, bathrooms, stairs, yards or the outer school wall and on the roofs and other sections of the building and transfer them to the approved landfills. As for the debris and waste resulting from the works in the building, their prices are included within the prices of the items themselves. The materials and reusable and recyclable parts or those resulting from other replacements of new ones shall be collected and delivered to the school administration by the contractor.

In any case, the material removal work from the site shall be carried out after having the approval of the supervising engineer and in accordance with his instructions.

It is the responsibility of the contractor to dispose of any residues resulting from the maintenance work. He shall also clean all the metal, wood, ceramic and floor elements that he has replaced and deliver the building clean and free of dirt.

Important Remarks:

- A) Any serious construction work inside the school building shall be prohibited during the students' time. The contractor is required to have the part of the yard that has been approved for the installation of the baths walled. The work shall be carried out after the end of the school hours and on holidays and weekends. Cleaning and draining sewers and drainage lines in the yard shall be carried out in presence of the school caretakers. The contractor shall be responsible for any damage or harm to students as a result of the works and shall also perform electrical, sanitary and other works outside the working hours. This condition applies to all the works that may be dangerous or harmful to the students' lives such as the works of the drinking facility, the installation of the WC facilities for students with special needs, the draining of the yard sewers and sewage pipes, etc. The contractor shall be liable for any physical or material damage to the students or the school's possessions as a result of poor consideration caused by him or his workers.
- B) Before the execution of the WC facilities, the contractor shall provide architectural and construction plans for the supervisor for approval. The contractor shall implement all the repairs and avoid the observations contained in the engineer's report and submit them again to the supervisor. Any WC facility units in the schools must be installed before obtaining the engineer's written.

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II. Sanitary and Mechanical Works:

According to the attached table of quantities, the maintenance and drainage of the drains, sub-sewers and mains in the yard and wastewater pipes, especially the new WC rooms shall be carried out. The works include removing the old sanitary appliances as well as the removal of all pipes and drainage of wastewater and potable water pipelines, the re-installation of sewage systems and a potable water system connected to the sewerage system, the potable water network and the water tanks, according to the table of quantities for each school in addition to executing two WC facilities (one for boys and another for girls) at each school. Each facility shall be equipped with four squat toilets and three washbasins (see specifications for the bathrooms rooms above). The wastewater pipes for all these works shall be made from high pressure UPVC with diameters of 6", 4" and 3" as required in addition to providing all the high pressure UPVC fittings, grouting and connection to the nearest sewer. Potable water pipes shall be made from PPR with internal diameters of 0.5" and ¾", 2.8mm thick (Touba Plast or an equivalent brand), and shall be connected to the school water network. The whole sanitary plumbing system shall be completely ready and working. The contractor shall install all the other requirements and fittings needed to finish the work mentioned in the tables of quantities. The materials must be of the quality brands available in the local market to fit the required purpose. Samples must be submitted to the engineer before executing any part of the work. Any material not matching the specifications shall be rejected by the engineer and must be replaced by the contractor without any surcharge.

The contractor shall test the extension of the potable water pipes, new network and sewers, which need to be approved by the supervising engineer before completing the works.

1. Wastewater network and UPVC sewage pipes:

The plastic pipes shall be made from polyvinyl chloride or non-elastic UPVC derivatives. They shall be used in the WC facilities for drainage and ventilation as well as in the external sewage network. They must be resistant to chemicals and sun shine. The pipes, fittings and accessories shall be homogeneous and smooth from the inside and outside as well as having no impurities, bubbles and cracks. Their thicknesses and diameters must be fixed with a 10% tolerance degree. The UPVC pipes shall be tried under high pressure up to 6kg/cm² and shall not be used in temperatures exceeding 65 degrees. They must be manufactured according to one of the international systems.

The pipes to be used shall be of the spigot and socket type connected with each other by an appropriate adhesive according to the manufacturer's instructions. The elbows and joints shall be of the open type. The work includes executing and installing the special accessories, sewers, etc. taking into account equipping them with the suitable covers. Tests shall be conducted on the laid pipe by filling it with water after having blocked the sub-holes to ensure having no leakage or defect for 30 minutes in addition to slightly knocking on it during the test (another method approved by the engineer may be used). The underground bet works made from UPVC pipes shall be fixed with cement mortar, which shall completely coat the pipes with at least 3cm thickness. As for the sewage networks in the site, sewage pipes shall be installed on a 10cm layer of 150kg regular concrete. The pipes shall not be installed until after completing the leveling and pouring the regular concrete over the specified part between two points or two manholes.

The pipes shall be laid in straight lines according to the direction and inclination between the inspection chambers. The lines shall be executed accurately according to the bottom and slope levels shown in the plans. Acceptable tolerance on the bottom levels shall not exceed 5mm provided that the final slopes between two points shall not change by 10% of

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the slopes given on the plan as well as maintaining the relative differences between the pipes. The drainage pipes shall be tested after being installed by 1m high vertical water pressure from the upper side of the pipes by filling the bottom end of the pipe with a rubber cap welded with a mortar or rubber disk. At the upper end of the disk a hole shall be fitted with a vertical tube with a funnel at the top.

During the test, the water level shall not drop in the funnel for 15 minutes. However, the water is allowed to subside with an equivalent of 1/10000 of the water volume in the pipe. During the test, all the points of contact shall be checked and the points of leakage shall be fixed. In general, no seepage or leakage shall appear in the pipes. A 30cm layer of coarse sand shall be laid over the pipes topped by another selected soil with no big stones, to be pressed if possible.

2. UPVC siphon floor drain: The drain shall have a UPVC siphon, type P, with a 3" or 4" hole as per its location in the plans. The siphon thickness must not be less 5mm and its water insulation must not be less than 5cm. the siphon shall be immersed in concrete. A nicked-brass sifter of a 10cm diameter shall be installed on its 15x15cm hole frame which has nicked-brass cover. The cover shall be fixed on the tiles by white cement without any protrusions, as per its location in the plans. The drain shall be accessed from four directions by the sanitary appliances.
3. UPVC sewer at least 5mm thick and with a diameter in line with those of the lines it is connected to and an altitude no less than 20cm. It shall have in/out holes from four directions. Each hole shall have a hub to be connected to the sewer body to ensure firm connection between the sewer and pipe. The sewer shall be equipped with a chrome cover with suitable dimensions and hole in the middle for checking and maintenance. The cover shall be firmly closed to prevent odour leakage, and shall be fixed at the tiles level.
4. Potable water pipes and PPR pipes: These pipes shall be used in executing all the under-wall/tiles plumbing. They shall be made from PP-R80 designed for passing potable water and cold/hot usage. This material is anti-corrosive and is not affected by liquids with high rates of chlorine or salts and can bear high temperature and pressures not less than 16bar. The pipes' life span shall not be less than 50 years under constant operation. The pipes shall be elastic causing no water noise, shock-resistant and easy to install. Moreover, they must be completely electricity and heat insulative. The pipe's section shall be equal and homogeneous along its length with a super smooth inner surface so that pressure loss is almost nil. Moreover, there shall be no sediments or impurities narrowing the inner diameter of the pipe. The manufacturer of these pipes, accessories, Tee's, adapters, etc. shall be internationally accredited to use the pipes with potable water. International certificates may include the Syrian standards 2314 and 2315 for the year 2000. The diameters of the pipes shall be as follows:

Nominal diameter (inch)	Nominal diameter (mm)
½	20
¾	25
1	32
1¼	40
1 ½	50
2	63

Pipes accessories:

The pipes accessories (elbows, Tee's, adapters, caps, etc.) shall be installed in the places specified in the plans. They shall be of the same pipe material, the same specifications and the same diameter.

As for the accessories required for connecting the pipes with the vales or sanitary appliances, they must be made from treated brass used for carrying potable water and coated with chrome to prevent corrosion in areas

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where the metal is in contact with PP-R80 or with water. The metal connection with PP-R80 must be perfectly firm. Moreover, they must heavy duty when installed or maintained. The price of those accessories shall be included in the price of the pipes they are installed on.

Installing PP-R pipes:

1. PP-R pipes shall be internally installed as is illustrated in the plans in terms of their diameter and manner of installation.
2. These pipes shall be connected to each other by welding with electric heating up to the melting point and then the installation is done immediately in order for the pipe particles and the accessory to fully mingle and become one part.
3. The pipes in all WC facilities shall be installed within the walls and must not be covered or hidden before running the impermeability test. Special care when extending the lines within the walls shall be taken so that the depths of the pipes allow the installation of metal accessories (valves, mixers, etc.) without being protruded or diving within the porcelain. The ends of the buried pipes shall be at least 5cm away from the cement plaster surface and shall allow the connection of these pipes to the distribution network at installation.
4. All parts of the supply network must be tested before covering the pipes in the walls. This test can be summarized by filling the network with water and then pressing the water with a special hand pump, up to the pressure of 6kg/cm². It is then confirmed that there is no air inside the pipes and the pressure remains constant for 24 hours, after which the network parts and fittings shall be checked and confirmed impermeable. In case there is a minor seepage, the leaking parts shall be dismantled.

Valves and faucets:

Faucets shall be made from chrome-plated brass with brass cores and a well-fixed handle on the axis. The cap between the axle and the valve body shall be completely waterproof, and shall meet the following conditions:

- Secure and free water passage when fully open and complete prevention when fully closed
- Its closure shall be gradual and slow so as to prevent the occurrence of waterways in the network
- Full cohesion of the internal parts in a way that does not give any sound at the movement and prevent rapid erosion as a result of friction
- They must be able to withstand the pressure of operating on the network and compression test after the installation, which is one and a half times the maximum operating pressure.
- Their disassembly, assembly, detection and maintenance must be easy and trouble-free
- Creating the least possible loss of pressure in the network
- The valves shall be installed on the pipes with serrated connections and in the specified places

3. Cleaning and draining the WC facilities and sewage points:

The work includes the removal of ceramic toilets, drains and sewers inside and outside the WC facilities and the removal of sludge, dirt, toilet seats, sinks, faucets, mirrors, shelves, doors, ceramics and marble, tiles, drinking facility faucets and rust and dirt. The price includes the supply and use of the materials necessary to complete the work in the required manner with labor wages and the transfer of sludge to the approved landfills.

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4. Executing the works of cleaning, draining and reopening the main:

The work includes cleaning main and the associated sewers as well as the inspection chambers and working on opening them and removing the suspended dirt by using technical means and the tools and materials necessary to finish the work to the engineer's approval. Then, the sewers shall be closed, the site cleaned and sludge removed to landfills. Clean the sewers and opening the main shall not be allowed during the students' time in school. The Contractor shall be responsible for any accidents that occur during the execution of this work.

5. Providing and installing a water pump with a protection box:

The pump must be Wilo, Salmson, Calpedo, Pedrello or any other equivalent brand available in the local market in terms of efficiency and the following specifications:

- Single-phased pump, at least 0.75kw (1hp), or as is mentioned in the table of quantities, with an elevation power no less than 25m, a density no less than 5m³/h, 1"x1", brass core, chrome axle, electric surge protection, and all the accessories, cables, breakers required to be connected with the electricity and water networks.
- The pump shall be equipped with an automatic sensor operating when water passes through the supply pipe, as well as a non-return valve and closure valves before and after the pump, and all the accessories and electrical fittings required for operating the pump in addition to a metal protection box.

6. Providing and installing plastic water tanks:

The water tanks must be made from harmless plastic specially made for water storage purposes and, at the same time, maintaining the natural and chemical properties of the stored water. The tank shall consist of three layers and is equipped with a plastic firmly closed cover to prevent pollution. The tanks must be locally made (Ghandour Plast, Rayyan Plast, Jumaa Plast, or any equivalent brand available in the local market).

The tank shall be equipped with a floater and is located on the roof of the school building or the roofs of the old/new WC facilities (according to what is mentioned in the tables of quantities and upon agreement with the school administration and the supervising engineer appointed by the Organization). The potable water pipes and fittings, they shall be included in the plastic water tanks installation item, or in a separate one, according to the table of quantities of each school. Plastic pipes shall be in line with the technical conditions.

7. General conditions for the sanitary appliances:

- the sanitary appliances must be of the local brands made from heat-crystallized porcelain, shiney, defectless with no stains, lines and warpage, harmonious in colour, having no cracks or fractures, give a strident sound when hammered, waterproof and with regular openings in line with the metal fittings to be installed on them.
- the appliances shall be installed in a way permitting their easy disassembly. They must be fixed with the pipes in a flexible way to avoid porcelain fracture when expanded by heat. They must not be installed until the works preceding them are completely executed.

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- The appliances' shape shall allow easy cleaning, having no hidden corners. Generally, all of their parts must be handy. Their surfaces must be tilted preventing water splash when hitting them. Moreover, the sanitary appliances and fittings must be completely harmonious, of the same brand and from a local source.

Sinks:

The sink shall consist of a white porcelain basin measuring 45x65cm. The basin shall have an open drain, floor and corners that are easy to clean. The porcelain shall be of a harmonious color without wavings or stains. The basin shall be equipped with a rubber stopper fixed on the sink. The sink shall have a ¼" chrome-coated brass siphon with water insulation no less than 7cm and a strainer of the same type. The sink shall be installed on a special metal rack and shall be firmly fixed in the walls at a height of 80cm from the surface of the final floor level. A 60x15cm porcelain shelf shall be installed on the sink in a suitable color suitable. A glass mirror measuring approximately 60x 45cm is mounted on top of the shelf a chrome-plated copper holder by stainless steel bolts. A porcelain soap holder (15x15cm) is installed on the right side of the user and within the sink boundary. It shall be of the semi-concealed type. The washbasin is equipped with a chrome long-necked faucet to be installed on wall, according to the tables of quantities for each school.

Squat toilets:

The toilet must be made from porcelain-coated cast iron, big sized and with a 4" hole and a neck of at least 5cm to be inserted in the draining siphon. The toilet shall be holes for letting water out based on a central siphon system – flowing valve – (in the new WC rooms). The toilet shall be at least 60cm long, smooth, defectless and easy to clean. The work includes providing and installing a hidden wall-mounted siphon machine directly connected with the water tank. The toilet shall be installed on a regular concrete base where it is inserted in it having the necked inserted into the siphon hole, around which it shall be grouted. Each WC room shall be equipped with a chrome wall-mounted faucet, class 1, and an additional hose. The toilet shall be Syrian made, Hamawiyyeh or any equivalent brand available in the local market. It shall have a paper holder installed on the left side of the user, or at the front. On completion of the WC installation works, the floor and sink spaces shall be tiled with Syrian made ceramic tiles, Zenobia, Balqees or any equivalent brand available in the local market.

III. The Technical Specifications of the Electrical Works:

General specifications:

- a. All the wires to be used must have high conductivity and made from PVC-insulated conductive copper for surface wires. The diameter of the cable feeding each WC room's breaker shall be at least 2.5mm², and that of the wires used to connect sockets 2.5mm², and that of the wires used for lighting 1.5mm² while that of the main cable feeding the breaker in each WC facility from the power supply sources mm². Wires must be of SMC brand, Sweidi Cable Co. brand or any other brand available in the local market.
- b. The wiring shall be wall-mounted and covered with plastic conduits.
- c. The light switches must be heavy duty, Vimar or an equivalent brand available in the local market, to be installed on the wall or concealed within the wall (as per the case of each school) and of the type tolerating high loads.
- d. Fluorescent lights must have the following specifications: electronic transformer (capacity factor no less than 90%), the holders must allow instant fixation of socket-connected transformers, spring sockets, and good lighting bulbs.

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- e. Breakers must be differential ensuring surge protection. They must be available in the local market and of the capacities mentioned in the tables of quantities.
- f. Samples of the electrical parts must be submitted to the engineer for approval before executing any part of the works. The contractor may replace, without any surcharge, any item incompliant with the specifications.
- g. The contractor shall remove the waste outside the worksite.
- h. Electricity maintenance works shall include checking the existing lighting devices, replacing the damaged ones according to each school allocated quantities, ensuring the functionality of transformers and starters and replacing the damaged ones in addition to replacing the damaged bulbs and sockets as required with energy saving bulbs according to the allocated quantities of each school, and checking the switches and repairing the damaged ones.
1. The works of providing and installing main and secondary power distribution panels and sockets and switches wiring:

Main distribution panels:

Electrical panel boxes:

- Made from steel sheets, treated with anti-corrosion base and thermal paint (Polyester, Epoxy Powder)
- Closed front with a glass
- Can accommodate the equipment and accessories as per the plans and as required while keeping a reserve space no less than 25%
- Nominal insulation: 1000w
- Nominal current: 400Amp
- Short circuit withstand: 50 lpk KA
- Withstand current time: 25 lcm 1s/rm KA
- The rods are designed to withstand the nominal current.
- The panel shall be connected and prepared at specialized workshops and by expert workers.
- The price includes providing the panel fully equipped and installing it with executing all the necessary works to the supervising engineer's approval.

Secondary wiring for lighting and sockets:

- Wiring the new WC facilities and other places specified in the tables of quantities:
- Hard PVC tubes
- Plastic or metal boxes produced by specialized companies, suitable for the position and purpose of usage (contents, loads, impermeability, dimensions, etc.) in the light of the accredited regulations and recommendations.
- Executing the wirings hidden within the concrete, block walls under the plaster and/or under the floor tiles.

When installing the hidden tubes:

- Avoiding any distortion or damage to the construction elements when installing hidden tubes

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- Considering the positions of the hidden tubes to be located as much as possible in the middle of the tiles thicknesses in a manner not causing any conflict with the reinforcement steel.
- The outer diameter of the tube must not, in any case, exceed a third of the distance of the concrete block it is located in.
- The tubes shall be as much as possible in parallel with the main reinforcement steel bars
- Avoiding the existence of water that may condense inside the tubes
- Maintaining the tube's section, avoiding the narrowing of its parts as a result of twisting or being bent in unsuitable radii
- Placing the curvature and elbows, as well as having middle boxes, in a manner ensuring having enough spaces for the possible wires to be inserted within
- Cleaning the tubes very well before inserting wires within, in addition to removing all sharp edges at their ends to avoid damaging the cables. The electrical works contractor shall be responsible for monitoring and ensuring the safety of the hidden installations and their system throughout the project stages.

When installing the boxes:

- The switch and socket boxes shall have an appropriate shape and size for their purpose
- The boxes type, method of installation and specifications of the parts to be installed within shall be decided
- Care shall be taken when positioning the boxes, in terms of position, level, straightness and firmness. For this purpose, regular parts in line with the execution method shall be used (tie bands, distance parts, etc.)
- The box sizes and holes design shall be in line with the tubes accessing it and with the connections within it
- All boxes shall have appropriate lids
- All connections inside the boxes shall be done with regular junctions suitable for the box and the connections within the box

Wiring:

- NYM cables are generally used to execute secondary wirings
- NYA conductors may be used in special cases decided by the supervisor

Executing the wirings:

- Within the abovementioned foundations, the tubes shall be verified before starting wiring
- Connection outside the connection boxes and electrical parts boxes is absolutely prohibited
- An additional 15cm shall be left within each box through which a cable passes
- Cables must not be subject to a curving radius exceeding 8 times its diameter
- Cables shall be inserted inside a tube at the same time using suitable lubricants and with the engineer's approval
- Cables ends shall be distinguished by labeling symbols showing the numbers of the circuits in the distribution panels.
- A uniform colour system shall be adopted for all wirings of the whole project in line with the accredited connections
- Cables shall be extended through separate tubes according to their usage (lighting, sockets, etc.)
- The conditions of ventilating the extended cables must be taken into account so that their proximity or accumulation does not lead to overheating them

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Accessories:

To achieve harmony in shape, all the accessories including switches, sockets, etc shall be procured from one source to facilitate having spare parts and testing them.

All parts shall be procured by virtue of forms signed by the engineer exclusively. They must be appropriate for the methods of installation mentioned earlier taking into account the following when procuring their components:

- Wall-mounted parts: Made from plastic, having high mechanical resistance and an impermeability degree no less than 44 IP
- Switches (single or double): dual-direction, 10Amp nominal current, 250v alternating nominal current, 10Amp switches
- Single sockets: 16Amp, with a pole for the phase and another for the neutral and an earthing pole. 250v nominal voltage, and with a hinged lid
- Distribution boxes: made from molded plastic, with dimensions suitable for the connections inside them, equipped with enough junctions, equipped with holes with ducts allowing cables to pass through without affecting their impermeability, and can be wall-mounted, ceiling-mounted or mounted on cable holders

2. Procuring and installing electric breakers:

Differential electric breakers ensuring protection, available in the local market, according to the capacities mentioned in the tables of quantities

3. Procuring and installing complete lighting points:

Providing and installing the entire bases and wirings required for feeding and operating lighting devices as from the power supply panel to the specified location (a lighting point site to feed a lighting device through switches). The price includes the tubes, cables, boxes, fittings, labor cost and accessories (40w energy saving bulb, porcelain socket, boxes, switch and lid)

- 4. Procuring and installing electrical sockets: providing and installing the entire bases and wirings required for feeding sockets as from the power supply panel or the previous socket (in reverse direction to the feeding). The price includes the tubes, cables, boxes, fittings, labor cost, 16Amp sockets, box and lid
- 5. Procuring and installing lighting devices (bulb with a socket, complete fluorescent light, fluorescent bulb)

General Specifications:

- All devices in the project must be made according to an international system and be marked with the following:
 - Manufacturer's name or logo.
 - Manufacturing System.
 - Degree of protection IP
 - Protective insulation for Class II protection
 - Fire Resistance Mark.
 - Factory check mark.

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Except where specifically stated otherwise, all devices are designed to operate at a voltage (220 V, 50 Hz) suitable for continuous operation at ambient temperature of 36 ° C.

The contractor shall supply, install and connect all lighting devices with the internal connections and all installation requirements according to the following general conditions:

- The bulbs to be used in the project shall be made according to approved specifications, with a guaranteed quality and from a source approved by the supervisor. The contractor shall supply the bulbs required for all devices according to the study and technical conditions. They shall be all brand-new when the facility is delivered. All bulbs that have been temporarily used for the contractor's uses in the implementation stages shall be excluded. The final bulbs shall be installed only with written permission.
- One of the following famous companies' products features shall be adopted:

(OSRAM - Germany) - (PHILIPS - Netherlands) - (MAZDA - France) or equivalent

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specifications of plastic containers (120) l

- Must be made of high density polyethylene.
- Must be equipped with a moving cover and rubber wheels.
- It should be environmentally friendly and easy to clean.
- Must be solid colors and resistance to the sun with the possibility of printing any logo (logo organization)
- Height 128 cm * Width 61 cm.
- Used for waste collection and must conform to the standard specifications of municipalities.



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Technical specifications of plastic containers (50) liters

- Must be made of high density polyethylene.
- Must be equipped with a sliding cover and a pedal.
- It should be environmentally friendly and easy to clean.
- Must be solid colors and resistance to the sun with the possibility of printing any logo (logo organization)
- The following dimensions are (W47xH65cm).
- Must be equipped with four wheels.
- it must not weigh more than 3 kg.
- Used for waste collection and must conform to the standard specifications of municipalities.

