

Preparation of detaild design of a
farmers' market in the municipality of
Al- Emarah, Missan

TECHNICAL SPECIFICATION

TABLE OF CONTENT

1.	EARTHWORK.....	3
2.	CAST-IN-PLACE CONCRETE STRUCTURES.....	14
3.	STRUCTURAL METAL WORKS.....	18
4.	MASONRY.....	23
5.	ROOFS AND ROOF RELATED METAL WORKS.....	32
6.	WATERPROOF INSULATION.....	41
7.	WALL FINISH.....	48
8.	FLOOR AND WALL TILING.....	57
9.	CEILING FINISHING.....	67
10.	PAINTS AND COATINGS.....	69
11.	DOORS.....	75
12.	WINDOWS.....	80
13.	PAVING WORKS.....	88
14.	LANDSCAPING.....	95
15.	FENCES AND GATES.....	100
16.	BATHROOMS AND TOILET FURNITURE AND FIXTURES.....	103

1. EARTHWORK

Earthworks shall comprise Excavation, Back-Filling and Compacting.

1.1 PART 1 - GENERAL

1.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1.1 American Society for Testing and Materials (ASTM) Publications

D 698-78	Moisture - Density Relations of Soil - Aggregate Mixtures Using 2.49 Kg hammer and 305 mm drop
D 1556-74	Density of Soil in Place by the Sand-Cone Method
D 1557-78	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 4.54 kg hammer and 457mm Drop
D 2922-81	Density of Soil and Soil Aggregates in Place by Nuclear Methods (Shallow Depth)

1.1.2 DEFINITIONS

1.1.2.1 *Topsoil*

Excavation of top soil material or undisturbed soil formations, fine grained, weathered materials on the surface or directly below and any loose or partially decomposed organic matter. Topsoil may be a dark-coloured, fine, salty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. The material shall be representative of productive soil in the vicinity.

1.1.2.2 *Hard Material*

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammer for removal.

1.1.2.3 *Unyielding Material*

Rock or soil with cobbles in the trench bottom requiring covering of finer grain material or special bedding to avoid bridging in the pipe or conduit.

1.1.2.4 **Unsatisfactory Material**

Soil or other material identified as having insufficient strength or stability to carry intended loads on trench backfills without excessive consolidation or loss of stability. Also backfill material which contains refuse, frozen material, large rocks, debris, and other material which could cause the backfill not to compact.

1.1.2.5 Unstable Material

Material in the trench bottom which lacks the firmness to maintain alignment and prevent joints from separating in the pipe, conduit, or appurtenance structure during backfilling. This may be material otherwise identified as satisfactory which has been disturbed or saturated.

1.1.2.6 Borrow Materials

Shall be materials conforming to the requirements for fill. Contractor shall obtain borrow materials from sources outside the site, at his own expense.

1.1.2.7 *Backfill*

Material used in refilling a trench or other excavation which has been excavated on the site of this project and which is free from rocks, foreign materials and decomposed or clayey soils.

1.1.2.8 Lift

A layer or course of soil placed on top of unprepared subgrade or a previously prepared or placed soil in a fill or backfill.

1.1.2.9 Compaction

Any method of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by required testing procedure.

1.1.3 SUBMITTALS

1.1.3.1 *Certified Laboratory Test Reports*

Before delivery of materials, certified copies in triplicate of the reports of all tests required herein under materials and in referenced publications shall be submitted to the Supervisor for approval. Additional testing shall be submitted when the source of materials is changed. Certified test reports are required for the following:

- (1) Fill and backfill

1.1.3.2 Contractor Furnished Plans, Shop Drawings & Certifications

All trench excavations, 1.5 meters deep and over or where it is known that the in-situ soils lack the stability to hold trench vertical surfaces shall be provided with a shoring system. Bracing or shoring shall be carried -"As long as the excavation progresses"-.

Contractor shall submit the following:

Shoring Plan: List materials to be used on shoring system, indicate components that will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional Supervisor registered in any jurisdiction for all major excavation work. Indicate sequence and method of installation and removal.

Dewatering Plan: Describe methods for removing collected water from open trenches and diverting surface water or piped water away from work area. Describe equipment and procedures for installing and operating the dewatering system indicated. Describe the basic components of the

dewatering system proposed for use, record performance and effectiveness of method or system in use and submit weekly.

1.1.4 SITE INFORMATION

It is expressly understood that the Contracting Authority will not be responsible for any interpretation or conclusion drawn from provided soil reports. The data are made available is purely for the convenience of the Contractor. Additional soil borings and other exploratory operations may be made by the Contractor at no additional cost to the Contracting Authority , provided such operations are approved by the Supervisor.

1.1.5 EXISTING UTILITIES

The location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall co-ordinate with the Supervisor for assistance in locating existing utilities. Approval for excavation shall be obtained from all relevant utility supply companies and a copy issued to the Supervisor.

1.1.6 MATERIAL STORAGE

Excavated materials classified as satisfactory soil material shall be stockpiled, where directed, until required for backfill or fill. Stockpiles shall be placed, graded, and shaped for proper drainage, and stored in a manner to prevent contamination and segregation. Materials required in the work shall be located and retained a sufficient distance from the edge of excavations to prevent such material falling or sliding back into the excavations and to prevent cave-ins. Waste materials, such as excavated materials classified as unsatisfactory soil material, trash, debris, and excess satisfactory soil material, shall be disposed of as directed by the Supervisor.

1.1.7 GENERAL REQUIREMENTS

Execution shall be based on the following:

That the surface elevations are as indicated.

That no pipes or other artificial obstructions, except those indicated, will be encountered.

That hard material will not be encountered.

The ground water indicated on the boring logs on the drawings are those existing at the time subsurface investigations were made and do not necessarily represent permanent ground water elevation.

In case the actual conditions differ substantially from those stated or shown, the provisions of the contract indicating an adjustment for changed conditions shall apply, subject to the requirements of notification there under being given. Hard material shall be defined as solid rock, firmly cemented non-stratified masses or conglomerate deposits possessing the characteristics of solid rock not ordinarily removed without systematic drilling and blasting and any boulder, masonry, or concrete except pavement, exceeding 0.4 cubic meters in volume.

1.2 PART 2 - PRODUCTS

1.2.1 MATERIALS

1.2.1.1 POROUS FILL

Where applicable, a capillary water barrier (indicated as porous fill) under concrete floor slabs shall consist of clean crushed stone, crushed gravel, or uncrushed gravel, 90-100 percent passing a 20 millimetres sieve and 0-5 percent passing a 4.75 millimetres sieve with sand equivalent of not less than 50. Granular fill may be composed of an appropriate combination of sand and crushed rock to meet the above gradation requirements. The capillary water barrier shall be placed directly on the subgrade. The barrier shall be constructed in layers not exceeding 10 centimetres in compacted thickness, and each layer shall be compacted with a minimum of two passes of a hand-operated plate type vibratory compactor.

1.2.1.2 SOIL MATERIALS

1.2.1.3 *Topsoil*

Topsoil shall be free of subsoil. Refuse, stumps, rocks over 3 centimetres, brush, weeds, and other materials detrimental to plant growth. Topsoil shall be obtained from an approved topsoil donor area.

1.2.1.4 *Satisfactory Soil Material*

Satisfactory soil materials used as backfill for trenches, drains and for structures shall consist of native materials classified as well graded sands, silty sands or clayey sands which are free from debris, roots, wood, scrap materials and other vegetable matter and refuse.

1.2.1.5 *Select Fill*

Select Fill material shall be composed of sand or crushed rocks. Backfilling shall be realized by compacting layers to achieve the level 96% Proctor Standard in case of cohesive soil material use, or $I_d > 0.67$ in case of no cohesive soil material use. The material to be used shall be approved by the Supervisor.

1.2.1.6 *River Sand*

The sand shall be natural river sand, made up of hard and clean particles, clear in colour and of spherical shape. The sand shall be clean and free from organic substances, clay, silt, and other impurities. The sand gradation composition shall be from 0.5 mm to 1.0 mm.

1.2.1.7 *Bedding Materials*

Shall be fine and coarse sands with a gradation from 0 millimetres to 3.0 millimetres.

1.3 PART 3 - EXECUTION

1.3.1 SURFACE PREPARATION

1.3.1.1 *Stockpiling Topsoil*

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be removed and disposed of off-site. Locate topsoil so that the material can be used readily for the finished grading. Where excavated topsoil conforming to the material requirements is not sufficient Contractor shall provide borrow materials suitable for use as topsoil. Materials obtained from different sources shall be stockpiled separately.

1.3.2 EXCAVATION

1.3.2.1 *General*

Excavation shall involve the removal and disposal of all materials encountered to obtain the specified subgrade elevations.

1.3.2.2 *Removal of hard material*

Notify the Supervisor immediately in writing if it becomes necessary to remove rock, or hard, unstable or otherwise unsatisfactory material to a depth greater than indicated. Immediately notify the Supervisor if utility lines, not indicate on the as-built drawings are encountered during excavation

1.3.2.3 *Protection of Persons and Property*

All excavations shall be barricaded and posted with warning signs for the safety of persons. Warning lights shall be provided during hours of darkness. Structures, utilities, sidewalks, pavements and other facilities immediately adjacent to excavations shall be protected against damage including settlement, lateral movement, undermining, and washout. Barriers shall be placed so that vehicle loading adjacent to excavations is avoided. Stop logs shall be placed at the edge of excavations to prevent vehicles over running when reversing up to the edge of open excavations.

1.3.2.4 *Excavation for Structures*

Excavation for structures shall conform to the dimensions and elevations indicated within a tolerance of plus or minus 15 centimetres and shall extend a sufficient distance from footings and foundations to permit adequate working room of at least 50 cm for the placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection. In excavations for footings and foundations, take care not to disturb the bottom of the excavation. Generally the final 10cm of excavations shall be removed shortly before placing of blinding concrete.

1.3.2.5 **Trench Excavation**

Excavation shall consist of excavating for foundations or utilities and plant distribution trenches. Make trench sides as nearly vertical as practicable except where sloping of sides is allowed.

1.3.2.6 Excavation for Building Pits and Foundations

Excavation works shall include excavations for sloped and lined building pits and foundations incl. preparation of bottom by levelling and compaction. Furthermore it shall include excavation for building pits and foundations incl. transportation up to 2 km and fill in ground with compaction.

1.3.2.7 Excavation for Paved Areas

Excavation shall consist of excavating and grading for paved areas; excavating all unsuitable materials regardless of character, from the subgrade; and disposing of all excavated materials, as specified and in conformity with the lines, grades, cross sections, and dimensions shown on the drawings, and to replace unsatisfactory materials from other excavation and grading operations.

1.3.2.8 *Unauthorized Excavation*

Unauthorized excavation consisting of removal of materials beyond indicated subgrade elevations or side dimensions without the specific approval of the Supervisor shall be replaced at no additional cost to the Contracting Authority. Unauthorized excavation under the footing or base of foundation shall be filled to the elevation of the footing or base of the foundation with lean concrete or well compacted select fill, without altering the approved top elevation. Elsewhere, unauthorized excavations shall be backfilled and compacted as per authorized excavations of the same classification.

1.3.2.9 Stability of Excavations

Sides of excavations over 1.5m in depth shall be sloped to the angle of repose of the excavated material, or shall be shored and braced where sloping is not possible either because of space restrictions or stability of materials excavated. Sides and slopes of excavations shall be maintained until completion of backfill placement in a safe condition by scaling, benching, shelving, or bracing. Precautions shall be taken to prevent slides or cave-ins when sides of excavations are subjected to vibrations from vehicular traffic or the operation of machinery or any other source.

Excavated material should not be closer to the edge of a supported trench than one-third of the trench depth. For unsupported trenches, this distance will depend on the depth of excavation, moisture content and cohesive strength of the material and profile of the excavation. Generally, excavated material should be placed outside a 45 degree slope line passing through the bottom of the excavation.

1.3.2.10 *Shoring and Bracing*

Materials used for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, shall be in good serviceable condition. All timber used shall be sound and free from large or loose knots. Shoring and bracing in excavations shall be maintained regardless of the length of time excavations remain open. All shoring and bracing shall be carried down with the excavation. Wherever subsequent removal of sheet piling could permit the lateral movement of soil under adjacent structures, sheet steel piling or pressure creosoted timber sheet piling shall be used, and left permanently in-place, and cut off as required.

1.3.2.11 *Water Removal*

Excavations shall be performed in a manner to prevent surface water and subsurface or ground water from flowing into the excavations and to prevent water from flooding the project site and surrounding area. Water shall not be permitted to accumulate in excavations.

All water shall be removed from excavations by approved dewatering methods so that softening of foundation bottom, undercutting of footings, and soil changes detrimental to the stability of subgrades and foundation will not occur. Pumps, sumps, suction and discharge lines and other dewatering system components shall be provided and maintained as necessary to convey the water away from the excavations. Dewatering operations shall be continuous until the completion of backfill placement and until construction subject to water pressure has obtained the full specified strength. In all instances, dewatering operations shall continue as long as water can enter or accumulate in the excavations. Water removed from excavations and rain water shall be conveyed to collecting channels, as approved by the Supervisor. Temporary drainage ditches and other diversions shall be provided and maintained outside the excavation limits for each structure. The use of trench excavations for site utilities as temporary drainage ditches will not be permitted.

1.3.3 **BACKFILL & FILL**

1.3.3.1 *General*

Backfill shall consist of the placement of specified backfill material, in layers, in the excavations to the indicated subgrade elevations, for each area classification listed below. Fill shall consist of placement of specified fill materials in layers, over the ground surface to the indicated elevations, for each area classified below:

1.3.3.2 *Backfill and Fill Materials*

Soil materials for backfill and fill shall be free of clay clods, rock or gravel larger than 6 centimetres. Debris waste, frozen materials and other deleterious matter of any dimension shall be removed. Fill shall be satisfactory soil materials as follow:

Area Classification	Backfill or Fill Material
In all excavations, unless otherwise specified hereinafter	Excavated or borrow material that has been sampled, tested and approved as "Satisfactory Soil Material."
Under Buildings	Select fill material and porous fill
Under sidewalks	Excavated or borrow material that has been sampled, tested and approved as "Satisfactory Soil Material."
Under roads	Sub-base material, or excavated or borrow material that has been sampled, tested and approve as "Satisfactory Soil Material".

Under grassed areas	Sub-base material, or excavated or borrow material that has been sampled, tested and approved as "Satisfactory Soil Material".
Gravel layer under foundation	Gravel layer under foundation, thickness according to drawings; from the borrow pit, tested and approved as "Satisfactory Soil Material"
Hollow layer above concrete slab	hollow space for piping passage, 700 mm height, realised with "Cupolex" type regenerated polypropylene element for the realization of ventilated floors. The elements, connected to each other, make up a self-supporting structure able to receive the concrete casting

1.3.3.3 *Preparation Prior to Backfill Placement*

Excavations shall be backfilled as promptly as the work permits, but not until completion of the following:

Approval of construction below finish grade.

Inspection, testing, approval, and recording location of underground utilities.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with satisfactory soil material temporary sheet piling driven below the bottom of structures and utilities shall be cut off and removed in a manner to prevent settlement of the structure or utilities.

Removal of rubbish and debris.

1.3.3.4 *Preparation of Ground Surface to Receive Fill*

Vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials shall be removed from ground surface prior to the placement of fills. Sloped surfaces steeper than one vertical to four horizontal shall be ploughed, stripped, or broken-up in such manner that fill material will bond with the existing material. When the ground surface has a density less than that specified for the particular area classification, the ground surface shall be broken-up, pulverized, and moisture-conditioned to near optimum moisture content of the soil material and compacted to the required depth and percentage of maximum density.

1.3.3.5 *Backfilling Trenches*

Trenches shall be carefully backfilled with materials specified, and deposited in 15 centimetres maximum layers, loose depth. Borrow materials shall be obtained from approved sources outside the site. The source of borrow material shall be the Contractor's responsibility. Utility surround material (as per bedding) shall be brought up evenly on both sides of the utility line for its full length, and shall be thoroughly and carefully tamped until utility line has a cover of not less than 30

centimetres. Care should be taken not to damage pipe or special coatings on utility line. Warning utility identification bands appropriate to the utility line shall be laid in the trench upon this layer. The remainder of backfill material shall be then deposited in the trench in 30 centimetres maximum loose layers and compacted by hand operated mechanical tampers. Trenches and excavation pit improperly backfilled or where settlement occurs, shall be reopened to depth required to obtain the specified compaction, then refilled and compacted with the surface restored to the required grade and compaction.

To prevent material loss through drainage effects in the bedding and surround material in trenches of steep gradient, barriers of impermeable material such, as puddle clay, shall be installed across the entire width of the excavation at least 30m centres measured along the line of the trench.

1.3.3.6 *Subgrade Preparation for Paved Areas*

After the grading is substantially complete, and immediately in advance of depositing the surfacing material, the subgrade shall be brought to the proper lines, grades, and cross sections as indicated and in accordance with these Specifications. All depressions and ruts shall be removed by blading and dragging so as to secure a uniform surface. The entire subgrade shall be brought to a firm, unyielding surface, true line, grade and cross section, by rolling with an approved power roller, until thoroughly compacted. This operation shall include any reshaping and wetting required to obtain proper compaction. All soft, spongy, or yielding spots shall be entirely removed and the space refilled with suitable material and thoroughly compacted. In those areas upon which a sub base or base course is to be placed, the top of the subgrade shall not show any deviation greater than 12 millimetres. Subgrade compaction shall be extended onto the shoulders for a distance of at least 30 centimetres beyond the edges of the base course or pavement. The subgrade shall be maintained in the finished condition until the first course of surfacing has been placed.

1.3.3.7 *Preparation of Planted Areas*

Planted areas shall be graded to the dimensions, elevations, and cross sections indicate on the Drawings. The top 10 centimetres, or as otherwise shown, of such areas shall consist of top soil as defined herein, which shall be lightly compacted. All material below the topsoil layer shall be compacted as specified for subgrade preparation.

The topsoil shall be uniformly distributed on the designated areas and evenly spread to an average thickness of 10 centimetres with a minimum thickness of 8 centimetres. Prior to placing the topsoil, the subgrade, wherever exceedingly compacted by traffic or other causes, shall be loosened by disking or by scarifying to a depth of at least 6 centimetres to permit bonding to the subgrade. The spreading shall be performed in such a manner that planting can proceed with little additional soil preparation or tillage. Any irregularities in the surface resulting from top-soiling and other operations shall be corrected in order to prevent the formation of depressions where water will stand. Topsoil shall not be placed when the subgrade is excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading.

1.3.4 COMPACTION

1.3.4.1 *General*

The compaction of soil materials for backfills and fills shall be performed by use of the specified compaction equipment that is suitable for the soil material being compacted and for use in the location of the work area. Soil compaction shall be controlled during construction for compliance with the percentage of maximum density for each area classification as specified.

1.3.4.2 *Compaction Equipment*

All compaction equipment shall be of suitable size and number, and in satisfactory working condition to complete the work on schedule. Compaction equipment shall consist of sheep's-foot rollers, pneumatic type rollers, tamper rollers, vibrating tampers, or other compaction equipment suitable for the soil material being compacted and capable of obtaining the required density throughout the entire layer being compacted.

1.3.4.3 *Placement and Compaction*

Backfill and fill materials shall be placed in layers not more than 15 centimetres in loose depth. Before compaction, each layer of backfill or fill material shall be moistened or aerated as necessary to provide the optimum moisture content of the soil material. The backfill and fill materials shall be compacted to 95% of the maximum density to a depth of no less than 25 centimetres for each area classification as specified. No backfill or fill material shall be placed on surfaces that are muddy, frozen, or contain frost, or ice. Backfill and fill materials adjacent to structures shall be brought-up evenly around the structure equal to the depth of backfill or fill material (measured from the bottom of footing or foundation or retaining wall) to final grade, shall be compacted with power-driven hand tampers. Porous fill shall be compacted with a minimum of two passes with a handheld vibratory compactor.

1.3.4.4 *Degree of Compaction*

Except where otherwise specified, the degree of compaction and density shall be determined and controlled in accordance with requirements of ASTM D 698.

1.3.4.5 *Density of soils in place*

Field determination of the density of soils in place shall be in accordance with ASTM D 2922.

1.3.4.6 *Compaction*

The subgrade of soils in cut shall have a density of at least 95 % of the maximum density to a depth of 25 centimetres below the subgrade surface. Fill, embankment, and/or backfill under concrete floor slabs and the upper 30 centimetres under paved areas shall be compacted to not less than 95 % of the maximum density; other backfill adjacent to and not supporting and structural elements to at least 90 %. The upper 30 centimetres of trenches shall be compacted to at least 95 % maximum density.

1.3.4.7 *Moisture Control*

Provide equipment capable of adding measured amounts of moisture to the top soil material as determined by moisture-density relation tests. The moisture content in the soil material at the time of compaction shall be within plus or minus two percent of optimum. For unsatisfactory soil materials where the subgrade or layer of soil material must be moisture conditioned before compaction, the required amount of water shall be uniformly applied to the surface of subgrade or layer of soil material in such manner as to prevent free water appearing on the surface during or subsequent to compaction operations. All soil material that is too wet to permit compaction specified percentage of maximum density shall be removed and replaced with satisfactory soil material. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread on the surface where directed by the Supervisor and permitted to dry, assisted by digging, harrowing or pulverizing, until the moisture content is reduced to a satisfactory value as determined by moisture-density relation tests, after which the soil material may be used in compacted backfill or fill.

1.3.5 GRADING

1.3.5.1 *General*

All areas within the limits of grading under this section, including adjacent transition areas, shall be uniformly graded. The finished surface shall be smooth within the specified tolerances, compacted, and within the tolerance specified below for each area classification, compacted as specified, and free from irregular surface changes.

1.3.6 RECONDITIONING COMPACTED AREAS

Where approved compacted areas are disturbed by subsequent construction operation or adverse weather, the surface shall be scarified, re-shaped, and compacted as specified hereinbefore to the required density prior to further constructions thereon, re-compaction over underground utilities shall be by hand tamping.

1.3.7 FIELD SAMPLING AND TESTING

1.3.7.1 *Testing*

All testing shall be conducted by the Contractor as specified herein at the expense of the Contractor.

1.3.7.2 *Granular Fill Testing*

Gradation test shall be made on each sample. Tests shall be performed for each 100 cubic meters of material used or fraction thereof and whenever the source is changed.

1.3.7.3 *Compaction Testing*

Compaction tests shall be made in locations as selected by the Supervisor as follows:

Materials	Test Frequency
(1) Fill and Backfill	1 per lift per every 100 m ²
(2) Subgrade (existing in-place density)	1 per lift per every 800 m ²
(3) Fill in trenches under pavement	1 per lift per every 200 m of trench

2. CAST-IN-PLACE CONCRETE STRUCTURES

2.1 PART 1 - GENERAL

2.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1.1.1 European Norms and Standards

DIN EN 12350-1 : 2001	On-site Concrete Sampling
DIN EN 12390-2	Concrete Test Specimens Preparation and Curing
DIN EN 12504-1	Sampling of Hardened Concrete
DIN EN 12390-3	Destructive Testing of Concretes Compression Test
DIN EN 934-2	Concrete Admixtures - Definition and Classification Concrete Admixtures - Air Entrainments Suitable Applications and Control Methods
DIN EN 206	Concrete
DIN EN 12350-2	Fresh Concrete - Determination of Consistency - Slump Test
DIN 18331	Construction contract procedures (VOB) - Part C: General technical specifications in construction contracts (ATV); Concrete work
DIN 18541-1	Thermoplastics sealing strips for sealing joints in in-situ concrete - Concepts, geometry and dimensions
DIN 18541-2	Thermoplastics sealing strips for sealing joints in in-situ concrete - Requirements, testing and inspection

2.1.2 SUBMITTALS

Submit the following:

2.1.2.1 *Manufacturers Data*

Submit for approval Materials for curing concrete.

2.1.2.2 *Shop drawings*

Submit shop drawings for the following. Reproductions of contract drawings as shop drawings are unacceptable.

Shop Drawings for Reinforcing Steel: Provide bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing rods.

Shop Drawings for Formwork: Furnish schedule of formwork.

2.1.3 DELIVERY AND STORAGE OF MATERIALS

Packaged materials shall be delivered to the project site in their original, unopened package or container. Packages will bear manufacturer's label clearly identifying manufacturer's name, brand name, material, weight or volume, and other pertinent information and stored in their original, unbroken package or container in a weather tight and dry place, until ready for use. Unpackaged aggregates shall be stored in a manner as to avoid excessive segregation or contamination with other materials or other sizes of aggregates. Store reinforcement of different sizes and shapes in separate piles, or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Provide for accurate identification after bundles are broken and tags removed. Ready-mix concrete shall not be delivered until forms, reinforcement and other embedded items are in place and ready for concrete to be placed. Prefabricated hollow slabs will be delivered and stored on site without being damaged.

2.1.4 CONCRETE QUALITIES

Concrete shall be in strict accordance with applicable portions of DIN EN 206-1. The concrete shall have a 28-day compressive strength as indicated in the table in paragraph 4.3.1.

2.2 PART 2 - PRODUCTS

2.2.1 CONCRETE AND REINFORCED CONCRETE

2.2.1.1 *Strength Requirements*

Concrete classified as follows shall be proportioned and mixed in accordance with DIN EN 206-1

Class	Characteristic 28-day Cube Strength	Classification to KTP/KTZ
XC2 C 16/20	20 N/mm ²	M-200
XC4 C 25/30	30 N/mm ²	M-300
XC1 C 25/30	30 N/mm ²	M-300
XC1 C 20/25	30 N/mm ²	M-250

(*)Concrete made with high early strength Portland cement shall have a seven-day compressive strength equal to the specified 28-day compressive strength of the class specified made with Portland cement. High early strength cement may be used only with specific written approval by the Supervisor. The quantity of cement per cubic meter of concrete is defined in DIN EN 206-1

2.2.1.2 Concrete Qualities

2.2.1.2.1 General

Concrete shall have a minimum compressive strength as indicated, in the table of paragraph 6.2.1.1 unless specified otherwise.

2.2.1.2.2 Concrete Consistency

Tests of the concrete consistency, esp. the slump test shall be carried out in accordance to DIN EN 12350-2

2.2.1.3 *Ready-Mixed Concrete*

DIN EN 206-1. Ready-mixed concrete is defined in this specification as concrete produced regularly by a commercial establishment and delivered to the purchaser in the plastic state. Ready-mixed concrete may be used provided that:

The plant has sufficient capacity and transportation equipment to deliver the concrete at the rate desired.

The interval between batches for a pour shall not exceed 30 minutes.

The time elapsing between the introduction of the mixing water to the cement and aggregates, or the cement to the aggregate, and placing of the concrete in final position in the forma shall not exceed one hour.

Ready mixed concrete shall be mixed and delivered by means of one of the following methods:

2.2.1.3.1 Central Mixing

Central mixing shall be done by mixing the concrete completely in a stationary mixer at the plant and transporting the mixed concrete to the site of the work in a truck agitator or a truck mixer operating at agitating speed.

2.2.1.3.2 Transit Mixing

Transit mixing shall be done in a truck mixer. Mixers and agitators shall be operated within the limits of capacity and speed of rotation designated by the manufacturer, and shall be capable of reproducing a homogeneous mixture of uniform colour. Weighing and moisture determination shall be as specified herein.

2.2.2 CEMENT

The cement type shall be ordinary Portland cement, if not specified separately. Portland cement shall comply in all respects with (DIN 1164) or (EN-2) for Ordinary Portland Cement.

2.2.3 WATER

Water shall be fresh, clean, and potable.

2.2.4 AGGREGATES

The Aggregates for concrete shall be coarse aggregate and fine aggregate conforming in all respects to ISO standards or equivalent standards. The grading should be such as to produce a concrete with the specified proportions and consistency and one that is readily workable.

2.2.5 CURING OF CONCRETE

Concrete must be treated during its curing so that conditions are created that allow necessary level of hydration to be reached and restrain the formation of shrinkage crack. Fresh concrete must not be exposed to shocks, vibrations or rapid cooling for 18 hours, and heating or drying for a period of at least 7 days.

2.2.6 TESTING OF CONCRETE

The Contractor shall make all necessary arrangements for the sampling and testing of fresh and hardened concrete in accordance with the provisions of (DIN 1048) and shall supply all necessary apparatus, labour, materials and transport.

2.2.7 FORMWORK

The Contractor shall be responsible for the design of the formwork and shall supply and fix all necessary formwork, together with its attendant scaffolding, timbering, shoring, strutting, etc., required for the place of concrete. Where timber boarding is used, the formwork surfaces coming in contact with wet concrete shall be made of properly seasoned timber, of sufficient thickness to resist the pressure of the wet concrete whilst it is being placed and vibrated, without any distortion whatsoever.

2.2.8 ADMIXTURES

Additives for concrete shall conform to DIN EN 206-1. Super plasticizer admixture shall come from the same manufacturer as other admixtures, or shall be certified to be compatible with all admixtures.

2.2.9 REINFORCEMENT

2.2.9.1 *Reinforcing Bar*

According to ENV 10080 shall be a ribbed reinforcing steel with a characteristic yield strength of 500 N/mm² and a minimum diameter of 8mm. (German BSt 500 S according to DIN 488).

Steel reinforcement shall be high tensile, high-bond deformed bars complying with the requirements of Albanian Standards or EU norms and with a guaranteed yield stress of not less than 420 N/mm².

Every 50 tons samples shall be taken and tested for:

- Tensile Strength
- Yield Point
- Elongation after fracture
- Behaviour in the bend test

- Behaviour in the rebound test
- Chemical composition

2.2.9.2 REINFORCEMENT ANCHORAGE

Reinforcement anchorage will 40 diameter if it has not a different specification.

2.2.9.3 *Welded Wire Fabric (mesh)*

According to ENV 10080 shall be a ribbed steel with a characteristic yield strength of 500 N/mm². It shall be electrically welded steel wire fabric for concrete reinforcement. (German BSt 500M according to DIN 488).

2.2.9.4 *Tie Wires*

Shall be 1.2 millimetres in diameter, black annealed wire.

2.2.10 CONCRETE PROTECTIVE COVER OVER REINFORCEMENT

The minimum concrete reinforcement cover shall be as follows:

Sides and bottom of footings cast against the earth	50 millimetres
Concrete exposed to the weather	35 millimetres
Concrete inside rooms	30 millimetres

2.2.11 END SPLICES FOR REINFORCING BARS

End laps of reinforcing bars shall be not less than 40 bar diameters, unless otherwise indicated.

2.2.12 WELDED-WIRE MESH LAP SPLICES

Minimum one full mesh plus 5 centimetres overhang on each end, unless otherwise indicated.

2.3 PART 3 - EXECUTION

2.3.1 FORMS

2.3.1.1 *General*

Set forms true to line and grades and make mortar-tight. Chamfer above grade exposed joints, edges, and external corners of concrete 20 millimetres unless otherwise indicated. Before concrete placement, coat the contact surfaces of forms with a non-staining form coating compound. Do not use mineral oil on formed surfaces to be painted. Prevent concrete damage during form removal. Concrete for footings may be placed in excavations without forms upon inspection and approval by the Supervisor. Excavation width shall be a minimum of 10 centimetres greater than indicated.

2.3.2 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

2.3.2.1 *General*

Provide bars, welded wire fabric, wire ties, supports, and other devices necessary to install and secure the reinforcement. Clean all reinforcement of loose, flaky rust, scale, grease, mortar, grout

or other coatings which may destroy or reduce its bond with the concrete. Reinforcement which has bends not shown on the project drawings or on approved shop drawings or which is reduced in section by rusting shall not be used. Placement of all reinforcement shall be inspected and approved by the Supervisor prior to pouring concrete. With a guaranteed yield stress of not less than 420 N/mm².

2.3.2.2 *Placing*

Reinforcement shall be accurately located in the forms, and firmly held in place, before and during the placing of concrete, by means of bar supports adequate to prevent displacement during the course of construction and to keep the steel at a proper distance from the forms.

Reinforcing bars shall be supported by concrete or metal chairs, by metal spacers, by metal bangers, or other approved supports. End laps for reinforcing bars shall not be less than 40 bar diameters unless indicated otherwise.

For slabs on grade (over earth) and for footing reinforcement, bars or mesh shall be supported on precast concrete blocks, spaced at intervals required by size of reinforcement used, to keep reinforcement the minimum height specified above the underside of slab or footing. Welded wire fabric shall be supported as required for reinforcing bars. Reinforcement shall be secured to supports by means of tie wire and shall be accurately placed and securely tied at all intersections with 1.6-millimeter diameter annealed wire. Wire-tie ends shall point away from the form. Welding of crossing bars shall not be permitted for assembly of reinforcement unless specifically authorized by the Supervisor.

2.3.2.3 *Setting Miscellaneous Material*

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

2.3.3 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE

Concrete shall be poured monolithically. Provide keyways (5 centimetres x 10 centimetres) where vertical wall intersects footings.

2.3.3.1 *Ready-mix Concrete*

Ready mix concrete furnished in revolving concrete mixers on trucks will be acceptable provided the requirements of DIN EN 206-1, and the following are met:

The ready-mixed concrete manufacturer shall furnish duplicate delivery tickets with each load of concrete delivered to the project site, one for the Supervisor and one for the Contractor. In addition to the requirements of DIN EN 206-1, the delivery tickets shall provide the following information:

Type and brand of cement
Cement content per cubic meter of concrete
Maximum size of aggregate
Total water content expressed by Water/Cement Ratio

Truck identification
Volume of concrete in truck
Batch time

Machine mix concrete and provide mandatory batch ticket information for each load of ready mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates.

2.3.3.2 *Placing*

Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 30 degrees Centigrade. Reduce mixing time to 60 minutes if the air temperature is greater than 30 degrees Centigrade. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. Do not place concrete when: (a) weather conditions prevent proper placement and consolidation; (b) in uncovered areas during periods of precipitation; and (c) in standing water. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within the forms. Concrete shall not be permitted to free fall over a height of more than 3 m to prevent segregation.

Consolidate concrete slabs greater than 10 centimetres in depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping.

Consolidate concrete slabs 10 centimetres or less in depth by hand rodding, tamping and spading.

2.3.3.2.1 Concrete Pumps

Concrete may be conveyed using concrete pumps only after written approval by the Supervisor. In requesting approval, the Contractor shall submit his entire plan of operation from time of discharge of concrete from the mixer to final placement in the forms. Concrete pumps shall be operated and maintained so that a continuous stream of concrete is delivered into the forms without air pockets, segregation, or change in slump exceeding 5 centimetres.

2.3.3.2.2 Concrete Vibration

Immediately after placing, each layer of concrete shall be vibrated using internal concrete vibrators supplemented by hand spading, rodding and tamping. Tamping or other external vibration of forms is not permitted. Vibrators shall not be used to transport concrete inside forms.

Internal vibrators submerged in concrete shall maintain a minimum frequency of not less than 8000 vibrations per minute. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation, generally from 5 to 15 seconds. Vibrators shall be applied at uniformly spaced points of 45 centimetres.

2.3.3.3 *Cold Weather*

Provide and maintain 10 degrees Centigrade minimum concrete temperature. Do not place concrete when the ambient temperature is below 5 degrees Centigrade. Cover concrete and provide with a source of heat sufficient to maintain 10 degrees Centigrade minimum while curing.

2.3.3.4 *Hot Weather*

Provide and maintain 32 degrees Centigrade maximum concrete temperature. Cool ingredients before mixing, or use other suitable means to control concrete temperature to prevent rapid drying of newly placed concrete. Shade the fresh concrete and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit curing without damage.

2.3.3.5 *Construction Joints*

If joints are necessary, their position will be agreed with the Supervisor

2.3.4 SURFACE FINISHING

2.3.4.1 *Defects*

Repair formed surfaces by removing minor honeycombs, pits greater than 2 square centimetres surface area or 6 millimetres maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with non-shrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb (including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate or other defects) which affect the serviceability or structural strength will be rejected, unless correction measure is submitted and approved by the Supervisor. The surface of the concrete shall not vary more than the allowable tolerances specified herein. Exposed surfaces shall be uniform in appearance and, finished to a smooth form finish unless otherwise specified.

2.3.4.2 *Floated Finish*

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleed-water appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. Do not spread dry cement over slab surface to absorb bleed-water. Do not introduce a "topping mix" over the floated finish of a slab to achieve a smooth finish. Steel trowelling shall be done over a floated finish before fresh concrete sets. Surface shall be level to within 6 millimetres in 3 meters where floor drains are not provided.

2.3.5 CURING AND PROTECTION

Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the curing period. Forms may be removed 48 hours after concrete placement. Prohibit foot and vehicular traffic and other sources of abrasion for not less than 72 hours after finishing operations.

2.3.5.1 *Moist Curing and Water Spraying*

Provide uniform and continuous application of water spray throughout the curing period. Curing shall be by direct application of water, accomplished by fog spraying or sprinkling. Flood surface with water after concrete has sufficiently hardened so, as not to be damaged by the spray. Apply water spray a minimum of two to three times a day and as often as ambient temperature and weather conditions dictate, for the minimum curing period of seven days. Allow concrete to cure under this method for a minimum period of seven days.

2.3.5.2 *Levelling of the supporting surface*

The surface must be levelled removing all irregularities.

2.3.5.3 *In-situ Slab*

Unless otherwise not indicated in drawings, to guarantee the continuity of adjacent elements a slab must as minimum be cast in concrete of resistance strength class C 25/30 (cube strength 30N/mm²), with reinforced welded wire mesh 20x20cm diameter 10mm, over the panels or ribs.

2.3.6 FIELD QUALITY CONTROL SAMPLING AND TESTING

Collect samples of fresh concrete to perform tests specified.

2.3.6.1 *Slump Tests*

DIN EN 12350-2. Take samples during concrete placement. Perform slump tests at (a) commencement of concrete placement, (b) when test cylinders are made, and (c) for each batch or every 10 cubic meters of concrete.

2.3.6.2 *Compressive Strength Tests*

DIN EN 12390-3. Make minimum of five test cubes with a measurement of 150/150/150mm for compressive test. Leave them in a water basin. Test the cubes at 28 days and hold one cube in reserve. Provide concrete cubes for compressive tests not less than once for each 30 cubic meters of concrete. Testing of specimens for compressive strength shall be in accordance with DIN EN 12390-3. Not more than 10% of the specimens tested shall have a compressive strength less than specified. When the results of the test of the control specimens indicate that the concrete as placed does not meet specification requirements or where there is evidence that quality is below specification requirements, core boring shall be accomplished in conformance with DIN EN 12504-1. The cost of such tests will be borne by the Contractor. Strength of cores from each member or area shall be considered satisfactory if their average is equal to or greater than 90 percent of the design compressive strength of the class of concrete. Remove all concrete not meeting this strength criteria and replace with new acceptable concrete at no additional cost to the Contracting Authority. Repair core holes with non-shrink grout. Match colour and finish with adjacent concrete surface.

2.3.6.3 *Surface Test*

After curing, test the surface of the pavement with a straightedge (minimum length 3 metres) which will reveal any irregularities in the concrete surface. Remove and replace the concrete, mechanically grind the concrete surface, or correct the surface as approved, of any portion of the pavement which shows irregularities greater than 3 millimetres in 3 metres, or irregularities in a transverse direction greater than 6 millimetres in 3 metres.

2.3.6.4 *Test Results*

Submit test results as part of the "Daily Report to Inspector" except that Compressive Test results shall be reported by separate correspondence or submittal.

2.3.6.5 STRIPPING OF FORMWORK

Formwork shall not be removed before the concrete has attained sufficient strength to support its own mass and any loads that may be imposed on it. This condition shall be assumed to require formwork to remain in place, after placing of the concrete, or the appropriate minimum period of time given in the Table below, unless the contractor can prove to the satisfaction of the Supervisor that shorter periods are sufficient to fulfil this condition.

Minimum periods before striking of formwork

Type of formwork -> Surface temperature of concrete -> 16°C -7°C

Vertical formwork to columns, -> 3 days - 5 days

Walls and large beams, -> 2 days - 3 days (Lateral formwork)

False-work to slabs, -> 4 days - 7 days

Props to slab false-work, -> 11 days - 14 days

False-work to beams, -> 8 days - 14 days

Props to beam false-work, -> 15 days - 21 days

Note: The Supervisor may allow a shorter period, when using Rapid Hardening Cement.

For cold weather periods should be increased by ½ day for each day the temperature falls between 7°C and 2°C, and one day for each day on which the temperature drops below 2°C. Formwork shall be removed carefully so that damage to the concrete is avoided.

3. MASONRY

3.1 PART 1 - GENERAL

3.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

3.1.1.1 European Norms and Standards

Brick/ Block-work

DIN EN 771-1	Specification for masonry units - Part 1: Clay masonry units
DIN EN 771-2	Specification for masonry units - Part 2: Calcium silicate masonry units
DIN EN 771-3	Specification for masonry units - Part 3: Aggregate concrete masonry units (Dense and light-weight aggregates)
DIN EN 771-5	Specification for masonry units - Part 5: Manufactured stone masonry units
DIN EN 771-6	Specification for masonry units - Part 6: Natural stone masonry units

Mortar

- DIN EN 998-1 Specification for mortar for masonry - Part 1: Rendering and plastering mortar
- DIN EN 998-2 Specification for mortar for masonry - Part 2: Masonry mortar
- DIN EN 1015-1 Methods of test for mortar for masonry - Part 1: Determination of particle size distribution (by sieve analysis)
- DIN EN 1015-11 Methods of test for mortar for masonry - Part 11: Determination of flexural and compressive strength of hardened mortar

Ancillaries

- DIN EN 845-1 Specification for ancillary components for masonry - Part 1: Ties, tension straps, hangers and brackets
- DIN EN 845-2 Specification for ancillary components for masonry - Part 2: Lintels
- DIN EN 845-3 Specification for ancillary components for masonry - Part 3: Bed joint reinforcement of steel meshwork

3.1.2 SUBMITTALS

Submit the following

Shop Drawings
Reinforcing steel
Movement joints
Masonry accessories
Reinforcement

Submit for each type samples:

Masonry units;
Concrete masonry units
Building brick
Facing brick
Mortar strength and properties
Masonry cement
Grout
Test Reports
Certificates
Manufacturer's Instructions

3.1.3 QUALITY ASSURANCE

3.1.3.1 *Appearance*

Do not change source or supply of materials after brick manufacturing work has started. Bricks shall be manufactured at one time and from the same batch. Blend all brick to produce a uniform appearance when installed. An observable "banding" or "layering" of colours or textures caused by improperly mixed brick is unacceptable.

3.1.3.2 *Testing*

Masonry strength shall be determined in accordance with Supervisor and the cost of testing shall be paid by the Contractor.

3.1.3.3 *Field Samples*

Masonry Panel Requirements At the project site submit for approval by the Supervisor, a sample masonry panel approximately 1200 mm long by 1200 mm high showing the workmanship, coursing, bond, weep holes, flashing, masonry ties and anchors, rigid-board insulation and tooling of joints. The sample panel shall be protected from damage and shall remain at the site until masonry work is complete and approved, at which time the panel shall be removed from the site. Masonry work shall match the approved sample.

3.1.4 DELIVERY, STORAGE AND HANDLING

Deliver cementous materials to the site in unbroken containers, plainly marked and labelled with manufacturers' names and brands. Store cementous materials in dry, weather-tight sheds or enclosures and handle so as to prevent entry of foreign materials and damage by water or dampness. Store masonry units off the ground and handle with care to avoid chipping and breakage. Protect materials from damage and, except for sand, keep dry until used. Cover sand to prevent intrusion of water and foreign materials and to prevent drying. Do not use materials containing frost or ice. Protect moisture controlled units from rain and ground water.

3.1.5 SCHEDULING

Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching.

3.1.6 BRACING

Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local building codes.

3.1.7 SEISMIC REQUIREMENT

In addition, the Contractor shall provide additional seismic reinforcement. The total minimum reinforcing percentage for structural walls shall be 0.20 percent and non-structural walls shall be 0.15 percent. Bond beams are required at the top of footings, at the bottom and top of openings at roof and floor levels, and at the top of parapet walls.

3.2 **PART 2 – PRODUCTS**

The approval of an offered product is given by the Supervisor at building site only after presentation of an acceptable sample of each type.

3.2.1 BRICKS

3.2.1.1 **Hollow Brick, Internal Walls**

Average dimensions of brick shall be as indicated in the drawings. The hollow bricks will be in according to DIN EN 771

3.2.1.2 *Hollow Brick- External Wall*

Average dimensions of brick shall be as indicated in the drawings. The hollow bricks will be in according to DIN EN 771

3.2.1.3 *Autoclaved aerated/lightweight concrete block*

Concrete Building Brick: lightweight units of modular dimensions and air, water, or steam cured. Concrete brick shall match the concrete masonry units in colour and surface characteristics.

3.2.2 MORTAR

3.2.2.1 *Mortar Properties* Mortar for masonry in dosage per 1 m³ shall be realised of

Lime mortar type 15 with river sand (which porosity of 40% and water content with relevant increasing of volume by 20%) mixed in proportion of cement: lime: sand = 1: 0, 8: 8. 110 lt hydrated lime, 150 kg cement (type 300), 1,29 m³ sand.

Lime mortar type 25 with river sand (which porosity of 40% and water connect with relevant increasing of volume by 20%) mixed in proportion of cement: lime: sand = 1: 0,5: 5,5. 92 lt hydrated lime, 212 kg cement (type 300), 1,22 m³ sand.

Lime mortar type 15 with clean sharp sand (to have a porosity of 35%) mixed in proportion of cement: lime: sand = 1: 0,8: 8. 105 lt hydrated lime, 144 kg cement (type 300), 1,03 m³ sand.

Lime mortar type 25 with river sand (to have a porosity of 35%) mixed in proportion of cement: lime: sand = 1: 0,5:5,5. 87 lt hydrated lime, 206 kg cement (type 300), 1,01 m³ sand.

Lime mortar type 1:2 with clean sharp sand (to have a porosity of 35%) mixed in proportion of cement: sand = 1:2. 527 kg cement (type 400), 0,89 m³ sand.

Water: Clean, potable, and free from substances which could adversely affect the mortar.

3.2.3 GROUT

Slump between 200 and 280 mm. Provide minimum grout strength of 13,800 kPa 2000 psi in 28 days.

3.2.3.1 *Admixtures*

Do not use air-entrainment, anti-freeze, or chloride admixtures.

3.2.4 MASONRY ACCESSORIES

3.2.4.1 *Horizontal Joint Reinforcement*

DIN EN 845-3 Fabricate from cold drawn steel wire. Wire shall be hot-dipped galvanized after fabrication. Reinforcement shall be truss type with two or more longitudinal wires welded to a continuous diagonal cross wire, or ladder type with perpendicular cross wires not more than 400 mm. Provide flat sections 3 m long, and preformed corners and tees approximately 800 mm long. Overall width shall be approximately 50 mm less than nominal thickness of wall.

3.2.4.2 *Anchors and Wall Ties*

Provide approved designs of stainless steel, Dovetail, flat bar or wire anchors: flat bar: sheet steel, not lighter than 16 gage, and 22 mm, with end turned up 6 mm. Wire: not lighter than 6 gage, 22 mm with wire looped and closed.

3.2.4.3 *Reinforcing Bars*

Provide positioners that prevent displacement of reinforcing during construction.

3.2.4.4 *Through-Wall Flashing*

Provide one of the following types

Coated-Copper Flashing: 0.2 kg 7 ounce, electrolytic copper sheet, uniformly coated on both sides with acid proof, alkali proof, elastic bituminous compound. Apply coating to a weight of not less than 1.8 kg per square meter 6 ounces per square foot (approximately 0.9 kg per square meter 3 ounces per square foot on each side).

Copper or Stainless Steel Flashing: Copper, minimum 450 g 16 ounce weight; stainless steel 4 mm thick. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions.

Reinforced Membrane Flashing: Polyester film core with a reinforcing fibreglass scrim bonded to one side. The membrane shall be impervious to moisture, flexible, and not affected by caustic alkalis.

3.2.5 SOURCE QUALITY CONTROL

3.2.5.1 *Efflorescence Test*

Conduct efflorescence tests on masonry units that are to be exposed to weathering. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary.

3.2.5.2 *Strength Calculation*

Compute compressive strength of masonry system. Submit calculations and certifications of unit and mortar strength.

3.3 PART 3 - EXECUTION

3.3.1 PREPARATION

Prior to start of work, masonry inspector shall verify the applicable conditions as set.

3.3.1.1 Protection

Stains Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surface with fibre brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

Loads: Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed.

Provide temporary bracing as required.

3.3.1.2 *Surface Preparation*

Surfaces on which masonry is to be placed shall be smooth, clean, and free of foreign substances when mortar is applied.

3.3.2 FIELD QUALITY CONTROL

3.3.2.1 *Mortar Strength and Properties*

DINEN 1015-11, for the first 3 consecutive days, and each third day thereafter.

3.3.3 WORKMANSHIP

Carry masonry up level and plumb. Furnish and use story poles or gage rods throughout the work. Changes in coursing or bonding after the work is started will not be permitted. Do not carry one section of the walls up in advance of the others. Step back unfinished work for joining with new work. Tothing will not be permitted. Check heights of masonry at each floor and at sills and heads of openings to maintain the level of the walls. Build in door and window frames, louvered openings, anchors, pipes, ducts, and conduits as the masonry work progresses. Fill spaces around metal door frames solidly with mortar. Handle masonry units with care to avoid chipping, cracking, and sapling of faces and edges. Drilling, cutting, fitting, and patching to accommodate the work of others shall be performed by masonry mechanics. Cut masonry with masonry saws for exposed work. Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork specified elsewhere shall be placed in position as the work progresses. Provide chases of approved dimensions for pipes and other purposes where indicated and where necessary.

Cover tops of exposed walls and partitions not being worked on with a waterproof membrane secured in place and extended down at least 600 mm on both sides.

3.3.4 MORTAR MIXING

Measure mortar materials in 0,0283 m³ containers to maintain control and accuracy of proportions. Do not measure materials with shovels. Mix mortar in a mechanical batch mixer for not less than 3 or more than 5 minutes after all ingredients are in so as to produce a uniform mixture. Add water gradually as required to produce a workable consistency.

Do not load mixer beyond its rated capacity. Re-temper mortar which has stiffened because of evaporation by adding water and mixing to obtain a workable consistency. Do not use or re-temper mortar which has not been placed in final position within 2 1/2 hours after the initial mixing.

Do not use antifreeze compounds, salts, or other substances to lower the freezing point of mortar. Mortar: Mix mortar in accordance with DIN EN 998-2 to obtain type mortar required. When masonry cement is provided, conform to masonry cement manufacturer's printed mixing instructions.

Grout: Provide fine grout in grout spaces less than 50 mm in any horizontal dimension or in which clearance between reinforcing and masonry is less than 20 mm.

3.3.5 MORTAR JOINTS

The mortar joints shall be applied in uniform thickness of 10 mm unless otherwise indicated. Tool exposed joints slightly concave with a round or other suitable jointer when the mortar is thumbprint hard. For horizontal joints, jointers shall be at least 300 mm long for brickwork and 600 mm long

for concrete masonry. Jointers shall be slightly larger than the width of the joint so that complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Brush joints to remove all loose and excess mortar. Horizontal joints shall be levelled; vertical joints shall be plumbed and in alignment from top to bottom of wall within a tolerance of plus or minus 10 mm in 10 m.

3.3.6 TOLERANCES

Masonry work shall be within the following limits:

Face of Brick: 1 mm from face of adjacent brick.

Face of Concrete Masonry Unit: 2 mm from face of adjacent unit.

Variation in Wall Thickness: Plus or minus 6 mm.

3.3.7 BRICKWORK

Provide brickwork that conforms to requirements of paragraph entitled "Tolerances" of this section. Select and place brick so that the better face of stretchers and headers is exposed.

3.3.7.1 *Testing*

Except during cold weather, test clay or shale brick daily on the job, prior to laying, as follows:

Using a wax pencil, draw a circle the size of a quarter on five randomly selected bricks.

Apply 20 drops of water with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, wet bricks represented by the five bricks tested.

Ensure that each brick is nearly saturated, but surface dry when laid. During cold weather, keep masonry units dry until laid.

Dry or butt joints will not be permitted.

3.3.7.2 *Application*

Unless indicated or specified otherwise, lay brick in running bond. Completely fill joints between bricks with mortar. Form bed joints of a thick layer of mortar slightly furrowed or battered; bevel or pyramid the bed mortar. Form head joints by applying a full coat of mortar on the brick to be laid. Slushing of head joints will not be permitted. Lay closure bricks with mortar on each bedding surface of unit to be laid and units in place. Place brick carefully without disturbing brick previously laid.

3.3.7.3 **Internal and External hollow brick masonry (20 cm)**

Masonry in hollow brick (6 divisions) with a thickness of 20 cm and lime mortar (type 25) including vertical openings, edges, off-sets, scaffoldings and anything else necessary to complete the masonry. On ground floor bedding shall be levelled a cement mortar layer 1:2, 2 cm minimum thickness. Select units for uniformity of size, texture, true plane, and undamaged edges and ends of exposed surfaces. Place units plumb, parallel, and with properly tooled joints of maximum 10 mm thickness. Keep exposed surfaces clean and free from blemishes or defects.

Hollow brick masonry 20 cm

Parapet made of clay hollow brick,
thickness 20 cm

3.3.7.4 Internal hollow brick masonry (10 cm)

Place brick masonry with a thickness of 10 cm including material for vertical openings, edges, offsets, scaffolding and all requirements to complete the work in a workmanlike manner. On ground floor bedding, shall be levelled a cement mortar layer 1:2, 2 cm minimum thickness. Select units for uniformity of size, texture, true plane, and undamaged edges and ends of exposed surfaces. Place units plumb, parallel, and with properly tooled joints of maximum 10 mm thickness. Keep exposed surfaces clean and free from blemishes or defects.

Internal Hollow brick masonry 12 cm Clay hollow brick masonry, thickness 12 cm; incl. lintel, belts, soffits, concrete bracings and scaffolding

3.3.8 BONDING AND ANCHORING

Unless indicated otherwise, extend partitions from the floor to the bottom of the construction above. Structurally bond or anchor walls and partitions to each other. Securely anchor non-load-bearing external walls and interior partitions to the concrete structures in a manner that provides lateral stability while permitting unrestricted deflection of construction above. Completely embed anchors in mortar joints.

Intersections of Non-Load-Bearing external Walls and Partitions with other Walls or Partitions: Tie with wire mesh ties at vertical intervals of not more than 60 cm or with masonry bonding in alternate courses.

Masonry Walls Facing or Abutting Concrete Members: Anchor masonry to concrete with dovetail or wire-type anchors inserted in slots or inserts built into concrete. Locate anchors not more than 300 mm. vertically and not more than 600 mm horizontally.

3.3.9 FLASHINGS

Provide as indicated. Unless indicated otherwise, extend flashing from a point 6 mm outside of exterior face of walls, upward in collar joint not less than 150 mm Bend down exterior edge to form a drip. Secure flashing ensure a permanent watertight joint as indicated. Provide flashing in lengths as long as practicable. Lap ends not less than 35 mm for interlocking type and 100 mm for other types. Seal laps as necessary to ensure watertight construction. Provide dams at ends of flashing where masonry abuts concrete and where flashing ends within the masonry.

3.3.10 WEEP HOLES

Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior. Weep holes shall be open head joints 600 mm.

3.3.11 HORIZONTAL JOINT REINFORCEMENT

Provide reinforcement in the first two courses above and below openings in walls and partitions of concrete masonry units. Reinforcement shall be continuous except at control joints and expansion joints. Reinforcement above and below openings shall extend not less than 600 mm beyond each

side of openings. Provide welded L-shaped assemblies and welded T-shaped assemblies to match the straight reinforcement, at corners and intersections of walls and partitions. Provide mortar cover for the wire of at least 16 mm for exterior face of wall and 12 mm for interior face of wall.

3.3.12 CONCRETE MASONRY UNIT LINTELS AND BOND BEAMS

Provide special units, fill cells solidly with grout or concrete, and provide not less than two No. 5 reinforcing bars, unless indicated otherwise. Reinforcing shall overlap a minimum of 40 bar diameters at splices. Concrete masonry units provided for lintels and bond beams shall have exposed surfaces of the same material and texture as the adjoining masonry units. Lintels shall be straight and true and shall have at least 200 mm of bearing at each end. Such units shall only be used in areas where at least three rows of brickwork shall be placed above the unit.

3.3.13 CONTROL JOINTS

Steel should be interrupted at joints for intermediate bond beams. Steel should continue through joint for all structural bond beams. Provide where indicated in concrete masonry-unit walls. Provide sawed type or built-in type as required. Joints shall occur directly opposite each other on both faces of the wall and shall be filled with sealant as specified in norms in reference or a properly formed synthetic rubber or vinyl plastic sealing strip as indicated.

3.3.14 EXPANSION JOINTS

Provide where indicated in brick walls. Fill joints with a permanently flexible preformed filler material and a sealant.

3.3.15 GROUT PLACEMENT

Place grout from the interior side of walls, unless approved otherwise. Protect sills, ledges, offsets, and other surfaces from grout droppings. Remove grout from such surfaces immediately. Grout shall be well mixed to prevent segregation and shall be sufficiently fluid to flow into joints and around reinforcing without leaving voids.

3.3.16 FORMS AND SHORING

Construct to the shape, lines, and dimensions of members indicated. Prevent deflections which may result in cracking or other damage to supported masonry. Do not remove until members have cured.

3.3.17 CLEANING

3.3.17.1 *Protection*

During cleaning operations, protect work which may be damaged, stained, or discoloured.

3.3.17.2 *Pointing*

Upon completion of masonry work and before cleaning, cut out defective mortar joints and tuck point joints and all holes solidly with pre-hydrated mortar.

3.3.17.3 *Cleaning*

Clean exposed masonry surfaces with clear water and stiff fibre brushes and rinse with clear water. Where stains, mortar, or other soil remain, continue scrubbing with warm water and detergent. Where soil still remains on brickwork, continue cleaning as follows: Thoroughly wet exposed surfaces of dark-coloured brickwork with clear water and scrub with stiff fibre brushes and a solution of not more than 1 part of muriatic acid (HCl) to 9 parts of water applied to an area of 1 to 2 square metre at a time. Immediately after cleaning each area, rinse thoroughly with clear water. Do not use caustic solutions or sandblasting to clean surfaces. Masonry shall be free of stains, efflorescence, mortar or grout droppings, and debris. Restore damaged, stained, and discoloured work to original condition or provide new work.

4. ROOFS AND ROOF RELATED METAL WORKS

4.1 PART 1 - GENERAL

4.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

4.1.1.1 European Norms and Standards

DIN 52130	Bitumen sheeting for water-proofing of roofs - Concepts, designation, requirements
DIN 52131	Bitumen water-proof sheeting for fusion welding - Concepts, designation, requirements
DIN 52132	Polymer bitumen sheeting for water-proofing of roofs - Concepts, designation, requirements
DIN 52133	Polymer bitumen water-proof sheeting for fusion welding - Terms and definitions, designation, requirements
DIN 52143	Bitumen roofing felt with glass fleece base; terms and definitions, designation, requirements
DIN EN 1253	Gullies for buildings
DIN 4102	Fire behaviour of building materials and elements
DIN 4109	Sound insulation in buildings; requirements and testing
DIN 18232	Smoke and heat control systems
DIN EN 54	Fire detection and fire alarm systems
DIN 18451	Construction Contract procedures for building works - Part C: General technical specifications for building works; Scaffolding works
DIN 18336	Construction Contract procedures for building works - Part C: General technical specifications for building works; Water-proofing works
DIN 18339	Construction contract procedures VOB - Part C: General technical specifications in construction contracts (ATV); Sheet metal roofing and wall covering work

DIN 18360	Contract procedures for building works - Part C: General technical specifications for building works; Metal construction works
DIN EN 13163	Thermal insulation products for buildings - Factory made products of expanded polystyrene (EPS) – Specification
DIN EN 13499	Thermal insulation products for buildings - External thermal insulation composite systems (ETICS) based on expanded polystyrene - Specification
DIN EN 826	Thermal insulating products for building applications - Determination of compression behaviour
DIN EN 1396	Aluminium and aluminium alloys - Coil coated sheet and strip for general applications
DIN EN 546	Aluminium and aluminium alloys - Foil
DIN 1748	Glass in building - Special basic products - Part 1: Borosilicate glasses
	<u>Glass in building - Special basic products - Part 2: Glass ceramics</u>
DIN 17440	Stainless steels - Technical delivery conditions for drawn wire
DIN EN 573	Aluminium and aluminium alloys - Chemical composition and forms of wrought products
DIN EN 1301	Aluminium and aluminium alloys - Drawn wire
DIN EN 612	Eaves gutters and rainwater down-pipes of metal sheet - Definitions, classification and requirements
DIN EN 988	Zinc and zinc alloys - Specification for rolled flat products for building;
DIN EN 1462	Brackets for eaves gutters - Requirements and testing
DIN EN 10147	Continuously hot-dip zinc coated low carbon steels strip and sheet for cold forming - Technical delivery conditions.
DIN EN 10214	Continuously hot-dip aluminium-zinc (AZ) coated steel strip and sheet. Technical delivery conditions
DIN EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
DIN ISO 4042	Fasteners - Electroplated coatings
DIN V ENV 1993	Design of Steel Structures
DIN EN 10025	Design of Steel Structures

4.1.2 SUBMITTALS

Submit the following:

Shop Drawings

Show a complete description of the procedures for the installation of each phase of the system indicating the type of materials, thicknesses, identity codes, sequence of laying insulation, location of ridges and valleys, special methods for cutting and fitting of insulation, and special precautions. The drawings shall be based on field measurements.]

Fasteners

Test Reports

Certificates

Manufacturer's Instructions

Nails and fasteners

Roof insulation, including field of roof and perimeter attachment requirements.

Waterproofing

Provide type, grade, dimensions, and details of truss beams and built-up girders, including reinforcing, accessories, anchorages, bending diagrams, assembly diagrams, splicing and laps of bars, shapes. Do not scale dimensions from structural drawings to determine lengths of reinforcing rods.

4.1.3 MANUFACTURER'S CERTIFICATE

Submit certificate from the insulation manufacturer attesting that the installer has the proper qualifications for installing tapered roof insulation systems.

4.1.4 DELIVERY, STORAGE, AND HANDLING

4.1.4.1 *Delivery*

Deliver materials to site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

Name of manufacturer;

Brand designation;

Specification number, type, and class, as applicable, where materials are covered by a referenced specification; and

4.1.4.2 *Delivery*

Deliver materials in sufficient quantity to allow continuity of the work.

4.1.4.3 *Storage and Handling*

Store and handle materials in a manner to protect from damage, exposure to open flame or other ignition sources, and from wetting, condensation or moisture absorption. Store in an enclosed building or trailer that provides a dry and adequately ventilated environment. Replace damaged material with new material. Rolls of material shall be stored vertically.

4.1.5 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below 5 degrees C or when there is ice, frost, or moisture visible on the roof deck or in high winds.

4.2 PART 2 - PRODUCTS AND MATERIALS

4.2.1 VAPOUR BARRIER

4.2.1.1 *Vapour Barrier*

Polyethylene Sheet

Vapour barrier shall be polyethylene sheet, thickness 0.50 mm, vapour permeability "s" greater than 2-100m, failure under traction 450%. The sheets are obtained from virgin granules, neutral or white colour, density Kg/dm³ 0.95, dry laying according to either of the following procedures:

- with 20 cm overlap and 10 cm rolling-up on the vertical parts,

- with 5 cm overlap, sealed with single-adhesive joint tape 8 cm wide, 10 cm rolling-up on the vertical parts.

Connections with all protruding bodies with joining tape – to be also used on vertical walls.

The separation layer shall be a fleece weighing 300 g/m².

Permeable screed membrane at ground level shall be an approved non-woven synthetic fibre fleece filter/slip sheet.

4.2.2 INSULATION

4.2.2.1 Insulation Types

Roof insulation shall be from Polystyrene Boards of thickness as indicated in drawings. It shall be of Extruded Polystyrene (XPS) of high density. The extruded polystyrene foam panel will be of the type with extrusion skin, expanded utilizing gases in accordance with EU and national regulations (CO₂), thermal conductivity λ_0 0.033 W/mK, compressive strength ≥ 3.7 kg/cm², coefficient of resistance to vapour diffusion μ 160 ÷ 224. The panels will have overlapping profile flaps on 4 sides for the elimination of thermal bridges, water absorption $\leq 0.10\%$ by volume, Euroclass E fire reaction and technical suitability for the insulation of light flat roofs according to DIN standards released by the Deutsches Institut für Bautechnik.

Installation

panels shall be laid with staggered joints

75 cm overlap of filter layer edges, with side rolling-up, in order to protect the membrane from damages due to under-insulation debris caused by water infiltration;

insert exhaust vents and gravel-grates – to ensure continuity of the insulation layer, the insulating panels shall be also laid along or above the drainage ditches, to be subsequently covered with concrete tiles;

utilize spacers/gravel layer below the pavement finishing layer for water drainage or, in case of driveway/walkable roof terrace, adequate reinforced concrete screed or mortar layer according to the calculated structural loads.

. Parapet insulation shall be rock mineral wool panels, with a hard core of high-density mineral wool fibre, thermal conductivity λ_0 0.035 W/mK, coefficient of resistance to vapour diffusion μ 1, delamination > 10 kPa, stress at 10% compacting > 30 kPa, A1 – non-combustible material – reaction to fire class.

Installation

It is important that in the case of fire rated panels the fixing details are designed so that the panels are retained in position in the event of a fire. Therefore:

all fixings should be steel and not aluminium,

steel angles/ channels to be a minimum of 1.6mm thick,

all rivets to be stainless steel.

4.2.2.2 *Insulation Thickness*

Will be provided as necessary to enable thermal resistance. Thickness shall be based on the "R" value for aged insulation. Insulation over steel decks shall satisfy both specified R value and minimum thickness for width of rib opening recommended in insulation manufacturer's published

literature. Thickness shall be not less 30 mm. Typical thicknesses will be 30, 50, 80 and 100 mm for rock mineral wool panels, 50, 80 and 100 mm for extruded polystyrene foam panels.

4.2.3 WATERPROOF BITUMEN MEMBRANE

Two prefabricated Damp Proof Membranes in polymer elasto-plasto-meric bitumen with a layer of fibreglass and or polyester sheet reinforcement, applied onto bituminous primer layer on horizontal and sloped surfaces, overlapping joints of 10 cm. The material shall be certified as compatible with the insulation material to prevent the loss of plasticizer.

Features:

elongation at break of the unarmed compound (NFT46002) 2000%,

resistance to longitudinal traction 90 transversal 80 Kg / 5cm,

elongation at break longitudinal 50% transversal 50%

resistance to fatigue on active crack at 0° C 10,000 cycles - at -10° C - 1,000 cycles,

cold flexibility - 25 ° C.

4.2.4 CEMENT AND SAND MORTAR

Cement and sand screed laid to achieve roof pavement with adhesives. Cement mortar substrate, dosage 3.00 quintals to 1.00 m³ sand, 30 mm average thickness (well levelled) for concrete and ceramic tiles floor, to be applied with adhesives, completed with perimetral expansion joints (resilient material pads).

4.2.5 ROOF PAVEMENT

Washed river gravel, 16/32 mm granulometry, minimum 4 cm thickness.

4.2.6 JOINT COVERING

Joint coverings shall be formed using 2x50x50mm wedges of insulation material each side of the joint. A separation strip shall be placed along both sides of the joint of minimum width 33 cm to prevent bonding and permit movement of the joint under the covering. The joint shall be covered using a 75 cm wide strip of roofing sheeting. This strip shall be fixed on both sides of the joint over a minimum of 25cm.

4.2.7 Pre-painted metallic cover system for roof parapet (t=0.5mm sheet flashing) including all necessary accessories

Supply and installation of covers, flashings and other metal finishing elements alongside walls and roof channels, various lengths, complete with seals, expansion joints, rivets and fasteners with screws or bolts, including masonry work for installation; Surface measurement will be net of overlaps. The elements will be realized in galvanized pre-painted sheets.

The sheets will be Fe Z3 type; thickness of not less than 6/10 mm, with continuous hot dipping galvanizing of medium-heavy type with 350 g / sqm zinc coating. The artefacts will be surface protected as specified below: the elements that may possibly suffer cuts, welds or other fitting works during assembly or installation, such as to cause damage to the zinc coating, must be carefully covered with painting based on inorganic zinc primer composed of inorganic polymers with the addition of metallic zinc.

Where prescribed in the executive design, the artefacts will be delivered onsite already pre-painted according to the following procedure:

- a two-component epoxy primer coat (40-50 microns) as a primer for the subsequent layers,
- an intermediate layer of two-component epoxy resins (60/80 micron),
- a top coat of two-component polyurethane resins non-yellowing, non-chalking (30-40 microns).

The Contractor must provide a ten-year guarantee on the quality of materials and the durability of the adopted surface protection.

4.2.8 NAILING OF INSULATION

Nails shall be suitable for the roof slab material. They shall not place the roof under excessive strain so as to avoid spalling. If the roof slab is not of suitable strength, then injection anchors shall be utilised.

4.2.9 ROOF GULLIES

Roof gullies shall have compressive flanges and be in accordance with DIN EN 1253. Cover grills to gullies shall be removable.

The sheets will be Fe Z3 type; thickness of not less than 6/10 mm, with continuous hot dipping galvanizing of medium-heavy type with 350 g / sqm zinc coating. The artefacts will be surface protected as specified below: the elements that may possibly suffer cuts, welds or other fitting works during assembly or installation, such as to cause damage to the zinc coating, must be carefully covered with painting based on inorganic zinc primer composed of inorganic polymers with the addition of metallic zinc.

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- a top coat of two-component polyurethane resins non-yellowing, non-chalking (30-40 microns).

The Contractor must provide a ten-year guarantee on the quality of materials and the durability of the adopted surface protection.

4.3 PART 3 - EXECUTION

4.3.1 EXAMINATION AND PREPARATION

4.3.1.1 *Surface Inspection*

Surfaces shall be clean, smooth, and dry. Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work. Supervisor will inspect and approve the surfaces immediately before starting installation. Prior to installing vapour barrier and insulation on precast decks, perform the following:

Examine precast concrete decks to ensure that joints between precast units are properly grouted and levelled to provide suitable surfaces for installation of vapour barrier and insulation.

4.3.1.2 *Surface Preparation*

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage and hollow or low spots and perform the following:

4.3.2 INSTALLATION OF VAPOR BARRIER

4.3.2.1 *Vapour Barrier on Precast Concrete Decks*

Install vapour barrier in direct contact with roof deck surface. Vapour barrier shall consist of one asphalt-saturated felt. Lay vapour barrier at right angles to direction of slope. Install felt within plus or minus 15 degrees C. Vapour barrier shall be free of wrinkles or buckles. Press out air bubbles to obtain complete adhesion between surfaces. At walls, edges, and other vertical projections, extend vapour barrier 150 mm to form a lap which shall later be wrapped around edge of insulation on top of vapour barrier.

4.3.3 INSULATION INSTALLATION

4.3.3.1 *Polystyrene and rock Panels Insulation*

Install non-composite polystyrene boards, high density of thickness as indicated in drawings. Tightly butt and stagger joints of field. Where indicated, provide cant strips at intersections of roof with walls, parapets, and curbs extending above roof

4.3.3.2 *Tapered Roof Insulation*

For sloping roofs or flat roofs with slopes for rainwater runoff, insulation shall be tapered to a slope of not less than 2 %, average depth 70 mm. Generally insulation shall be installed so as to avoid thermal bridges.

4.3.3.3 *Cants and Tapered Edge Strips*

Provide preformed cants and tapered edge strips of the same material as the tapered roof insulation. Face of can't strips shall have incline of 45 degrees and vertical height of 100 mm.

4.3.3.4 *Installation at Roof Gullies*

At roof gullies the insulation shall be lightly angled (approx. 20mm)

4.3.4 INSTALLATION BITUMEN MEMBRANE

Two layer prefabricated Damp Proof Membranes in polymerelasto-plasto-meric bitumen, applied onto bituminous primer layer on horizontal and sloped surfaces, overlapping joints of 10cm, including labour and provisional operations; with a layer of fibreglass and or polyester sheet reinforcement. The manufacturer's labelling of rolls shall not be removed until immediately before use.

For each of two layers' torch-on or electric heat-apply fully adhered sheets. Unroll sheets, set in place with 100 mm side laps and 150 mm end laps. Apply heat to underside of roll and 75 mm side lap of preceding roll and fully adhere membrane to the substrate by unrolling the heated portion

of the roll onto the substrate. Ensure a minimum flow of bitumen of at least 10 mm, not to exceed 25 mm, on side and end laps as the membrane is rolled forward and adhered to the substrate. Care shall be taken so as not to overheat the top surface of the roll. After membrane has been adhered to substrate, check laps with a hot trowel to ensure laps are fully adhered. At areas where full adhesion of the laps is not obtained, reheat and trowel. Joints in membranes shall be staggered by at least 50cm.

Apply modified bitumen sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces (minimum 150 mm), in accordance with membrane manufacturer's printed application instructions and where necessary to make the work watertight. The flashing shall be positioned between the two layers with the upper layer uniformly bonded onto the flashing. The joint shall receive a hot applied bituminous liquid coating. Roof sheeting shall be laid on 100x100 mm wedges (can't strips) of insulation material at the corner between the horizontal and vertical surfaces.

4.3.5 ROOF GULLIES

The waterproofing membrane shall be taken into the flange and secured. Gullies with S bends to prevent odour emissions shall be filled with water. All gullies shall be sunken so as to completely drain the surrounding roof and shall be installed so as to prevent cold or warm bridges.

4.3.6 CEMENT AND SAND MORTAR

Prior to covering the waterproofing, a partial acceptance shall be carried out with the Supervisor. Cement and sand screed laid to receive roof pavement. Thickness 50 mm

4.3.7 JOINT COVERING

Expansion joints in roofing will be used. Provide at each expansion joint in structure. Place on curbs above water line. Do not restrict drainage of water from roof.

4.3.8 NAILING OF INSULATION

Nailing shall be made at joints of roof sheeting at least 10cm from the edge of the sheet. At least 3 Nails per m² shall be provided for buildings up to 20m with a minimum of 6 nails per m at edges and 9 nails per metre at corners.

4.3.9 FIXINGS

Fixings for metal works (screws, raw plugs, anchors etc.) shall be suitable for the materials in which they are installed. Excessive subsection of strain shall be avoided when installing fixings.

4.3.10 PARAPET WALL COVERINGS

Copings to parapet walls shall be in coated steel in colour as agreed with the Supervisor. Joints in copings shall be underlain with joint sheets.

4.3.11 HOT DIPPED GALVANISED FITTINGS

Hot dipped galvanised fittings shall be formed prior to dipping. If drilling of galvanised items is necessary after they have been dipped, then the drill hole shall be treated with cold galvanic coating immediately after drilling.

4.3.12 GUTTERS

Gutters shall be laid with a gradient of at least 3 mm per m unless otherwise indicated. PVC gutters are not permitted.

4.3.13 DOWN PIPES

Down pipes shall be in galvanised steel. Joints shall be visible and spigots shall extend at least 5 cm into sockets. If the joint is held by a rim, then soldering is not necessary.

4.3.14 SOLDERED CONNECTIONS

Over laps shall be at least 10 mm. For horizontal and lightly sloped items 10 mm wide welds are required. For vertical or steeply sloped items 5 mm welds are sufficient. The weld gap shall not be greater than 0,5 mm to ensure adequate capillary action.

4.3.15 SHARP METAL EDGES

Sharp edges of metal sheeting shall be ground down. For sheets up to 1 mm thick a protection bead shall be utilised.

4.3.16 REMOVAL OF CUTTINGS AND BORINGS

Metal cuttings and borings as well as metal dust produced during grinding activities shall be cleaned from the permanent works immediately upon completion of the cutting works.

4.3.17 PROTECTION

4.3.17.1 *Protection of Applied Insulation and Waterproofing*

Do not permit phased construction. Protect open ends of each day's work with temporary water cut-offs and covers, and remove when work is resumed. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces.

4.3.17.2 *Damaged Work and Materials*

Restore work and materials that become damaged during construction to original condition or replace with new materials.

4.3.17.3 *Hot Working*

The storage of pressure gas cylinders in basements, stairwells, corridors and escape routes is forbidden. During hot working with inflammable gases hand held fire extinguishers according to DIN EN 3 must be readily available immediately adjacent to the area of working.

4.3.17.4 *Protection of Metalwork*

All metal fittings at roof level shall be protected against white rust and bitumen corrosion by applying a protective coating compatible with the roofing material up to 2 cm above the finished roof level.

4.3.17.5 *Clean-up*

Upon completion of the works all debris shall be removed from site including any debris which has fallen onto ledges, sills, gutter and the like on the building as well as any material which has fallen to ground level

5. WATERPROOF INSULATION

5.1 PART 1 - GENERAL

5.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

5.1.1.1 European Norms and Standards

- DIN 18195 – 1 Water-proofing of buildings - Part 1: Principles, definitions, attribution of waterproofing types.
- DIN 18195 – 2 Water-proofing of buildings - Part 2: Materials.
- DIN 18195 – 3 Water-proofing of buildings - Part 3: Requirements to the ground and working properties of materials.
- DIN 18195 – 4 Water-proofing of buildings - Part 4: Water-proofing against ground moisture (capillary water, retained water) and non-accumulating seepage water under floor slabs and on walls, design and execution.
- DIN 18195 – 5 Water-proofing of buildings - Part 5: Water-proofing against non-pressing water on floors and in wet areas; design and execution.
- DIN 18195 – 6 Waterproofing of buildings and structures; waterproofing sheeting subjected to hydrostatic pressure from the inside; design and workmanship

5.1.2 SUBMITTAL

Items in the following lists shall be approved by the Supervisor:

Manufacturer's Catalogue Data
Insulation board
Modified bitumen polymer sheet

Bitumen Primer
Prefomed compression seals
Joint sealants

Instructions
Insulation board
Modified bitumen polymer sheet
Bitumen Primer
Prefomed compression seals
Joint sealants

Include detailed application instructions and standard drawings altered as required by these specifications. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

5.1.2.1 **Statements**

Qualification of manufacturer
Qualification of applicator

Certify that the manufacturer of the modified bitumen membrane meets specified requirements.

5.1.3 **DELIVERY, STORAGE, AND HANDLING**

5.1.3.1 *Delivery*

Deliver materials in manufacturers original unopened containers and rolls with labels intact and legible. Mark and remove wet materials from the site. Where materials are covered by a referenced specification, the container shall bear the specification number, type, and class, as applicable. Deliver materials in sufficient quantity to allow work to proceed without interruption.

5.1.3.2 *Storage*

Protect materials against moisture absorption. Store roll materials op end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Maintain roll materials at temperatures above 10 degrees C for 24 hours immediately before application. Do not store materials outdoors unless approved -by the Supervisor.

5.1.3.3 *Handling*

Select and operate material handling equipment so as not to damage applied membrane. Prevent damage to edges and ends of roll materials.

5.1.4 ENVIRONMENTAL REQUIREMENTS

Do not install membrane when air temperature is below 4 degrees Centigrade, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck.

5.2 PART 2 - PRODUCTS

5.2.1 INSULATION

5.2.1.1 *Board Insulation*

Board insulation for ground floor slabs shall be of extruded polystyrene (XPS) insulation boards of thickness or as indicated in the drawings.

5.2.1.2 *Accessories*

5.2.1.2.1 Adhesive

As recommended by insulation manufacturer.

5.2.2 WATERPROOFING

5.2.2.1 *Impermeable Membrane*

In polymer elasto-plasto-meric bitumen, with a layer of glass fibre or polyester sheet reinforcement, weighing 3Kg/sq.m minimum. The material shall be certified as compatible with the insulation material to prevent the loss of plasticizer. Features:

- elongation at break of the unarmed compound (NFT46002) 2000%,
- resistance to longitudinal traction 90 transversal 80 Kg / 5cm,
- elongation at break longitudinal 50% transversal 50%
- resistance to fatigue on active crack at 0° C 10,000 cycles - at -10° C - 1,000 cycles,
- cold flexibility - 25 ° C.

For walls

Damp proof membranes for walls, 4mm thickness, in polymer elastomeric bitumen, applied on bituminous primer layer

For foundations

Damp proof membranes for foundations, 4mm thickness, in polymer elastomeric bitumen, applied on bituminous primer layer

For slabs

Damp proof membranes for slabs, 4mm thickness, in polymer elastomeric bitumen, applied on bituminous primer layer

5.2.2.2 *Bitumen Prime*

In a bitumen solution or emulsion

5.2.2.3 **Polyethylene (PE) Foil**

UV-stabilised PE foil made of primer PE and in accordance with EN 13984:2013 with the following characteristics: SD value > 100 m, thickness min 100 µ, temperature resistance +70 °C, application temperature -10°C to +40°C

5.2.3 **JOINTS**

5.2.3.1 **Joint Filler**

5.2.3.1.1 For Expansion Joints

Filler must be compatible with joint sealer material. Water-stop joints shall be made of expansion joint water stops, 225 mm wide, Material: rubber. All construction and expansion joints are included in the concrete prices.

5.2.3.2 **Bond Breakers**

5.2.3.2.1 Blocking Media

Compressible, non-shrinkable, non-reactive with joint sealant and non-absorption type such as plastic rod, free of oils or bitumen. Blocking media shall have a water absorption of not more than 5 percent by weight when tested. Blocking media shall be consistent with joint seal manufacturer's installation instructions and be at least 25 percent larger in diameter than width of joints as shown.

5.2.3.2.2 Separating Tape

Polyethylene or polyester tape, 0.08 mm 3 mil minimum thickness, or masking tape, non-reactive, non-absorptive, adhesive back tape, width equal to width of joints as indicated. Separating tape shall be consistent with joint seal manufacturer's installation instructions.

5.2.3.3 *Joint Sealants*

Single Component Cold-Applied Silicone. Silicone sealant shall be self-levelling, non-acid curing

5.2.3.4 *Dowel Bars*

Bars shall conform for plain billet-steel bars of size and length indicated.

5.2.4 **GEOTEXTILE FOR STRUCTURES**

5.2.4.1 **General**

Where indicated on the Drawings or directed by the Supervisor(façade walls, roof etc.), the Contractor shall provide plastic filter fabric (Geotextile). The geotextile fabric will be composed of polypropylene or polyester without the use of adhesives. It will be realized according to one of the following:

- with continuous filament fiber,
- with intertwined fiber ("warp and weft" industrial weaving system),
- with adequate intertwined fiber length obtained by mechanical needling.

The Contractor shall submit details, with a certificate stating name of the manufacturer, product name, style number, chemical composition of the filament or yarns and other pertinent information, and samples of the proposed material to the Supervisor for review and approval.

Geotextiles labelling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

Each Geotextile roll shall be wrapped with a material that will protect the Geotextile from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from damaging the physical property values of the Geotextile.

5.3 PART 3 - EXECUTION

5.3.1 INSULATION

5.3.1.1 *Verification of Conditions*

Before installing insulation, ensure that all areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapour retarders. If installing perimeter or under slab insulation, check that the fill is flat, smooth, dry, and well tamped. If moisture or other conditions are found that do not allow the proper installation of the insulation, do not proceed but notify the Supervisor of such conditions.

5.3.1.2 **Installation Insulation Board**

Install and handle insulation in accordance with the manufacturer's installation instructions. Keep material dry and free of extraneous materials. Observe safe work practices.

5.3.1.3 **Installation on Masonry Walls**

Apply board directly to masonry with adhesive or fasteners as recommended by the insulation manufacturer. Fit between obstructions without impaling board on ties or anchors. Apply in parallel courses with joints breaking midway over course below. Put ends in moderate contact with adjoining insulation without forcing. Cut and shape as required to fit around wall penetrations, projections or openings to accommodate conduit or other services. Seal around cut-outs with sealant. Install board in wall cavities so that it leaves at least a nominal 25 mm one air space outside of the insulation to allow for cavity drainage.

5.3.1.4 Installation on Underside of Concrete Floor Slab

Size insulation to cover underside of slab. Apply adhesive to slab and set fasteners in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners, bend split prongs flush with insulation. All edges of insulation and seal with tape.

5.3.1.5 Protection of Insulation

Protect insulation on vertical surfaces from damage during construction and back filling by application of 5 cm thick polystyrene drainage. Do not leave installed vertical insulation unprotected overnight. Install protection over entire exposed exterior insulation board.

5.3.2 WATERPROOFING

5.3.2.1 Verification of Conditions

Ensure that the following conditions exist prior to application of the membrane materials:

Drains, curbs, cants, and equipment supports are in place.

Surfaces are rigid, dry, smooth, and free from cracks, holes, and sharp changes in elevation.

Substrate is sloped as indicate to provide positive drainage.

Cast-in-place substrates have been allowed to cure and the surface dryness specified requirements have been met. Substrate curing shall be compatible with membrane system.

All corners are rounded using wedges of insulation material or mortar to prevent creasing of the membrane.

5.3.2.2 *Priming of Concrete Surfaces*

After surface dryness requirements have been met, coat concrete surfaces which are to receive membrane sheet uniformly with a coat of bitumen primer. The primer shall be applied in the ratio 130g/sq.m and have a minimum 3 mm (dry) thickness. Allow primer to dry prior to application of membrane sheet.

5.3.2.3 *Application*

Apply membrane as specified by manufacturer's printed application instructions. Keep materials dry before and during application. Do not, permit phased construction. Complete application of membrane in a continuous operation. Maintain specified temperatures for bitumen.

5.3.2.3.1 Modified Polymer Bitumen sheets

Sheets shall be watertight and visually free of pinholes, particles of foreign matter undispersed raw material, or other manufacturing defects that might affect serviceability. Edges of seams shall be straight and flat so that they may be seamed to one another without forming fish mouths or wrinkles.

5.3.2.3.2 Modified Polymer Bitumen Sheets

Torch-on or electric heat-apply fully adhered sheets. Unroll sheets, set in place with 250 mm side laps and 250 mm end laps. Apply heat to underside of roll and 100 mm side lap of preceding roll and, fully adhere membrane to the substrate by unrolling the heated portion of the roll onto the substrate. Ensure a minimum flow of modified bitumen of at least 10 mm, not to exceed 25 mm, on

side and end laps as the membrane is rolled forward and adhered to the substrate. Care shall be taken so as not to overheat the top surface of the roll. After membrane has been adhered to substrate, check laps with a hot trowel to ensure laps are fully adhered. At area where full adhesion of the laps are not obtained, reheat and trowel into place so that adhesion of the entire lap is accomplished. If prefabricated elements shall be fitted to the waterproofed surface (such as basement window cases) the waterproofing shall extend at least to the inside edge of the unit before installation.

5.3.2.3.3 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

5.3.2.3.4 Protection of Applied Membrane against Moisture

At the end of the day's work and when precipitation is imminent protect applied modified bitumen membrane system. Applied membrane is shall also be shaded from strong direct sunlight.

5.3.2.4 Field Quality Control

Perform field tests in the presence of the Supervisor. Notify the Supervisor one day before performing tests.

5.3.2.4.1 Test for Surface Dryness

Before application of membrane sheets and starting work on the area to be roofed. Dryness shall be greater than 0,03%.

5.3.2.4.2 Instructions to Contracting Authority's Personnel

Furnish written and verbal instructions on proper maintenance procedures to designated Contracting Authority's personnel. Furnish instructions by a competent representative of the modified bitumen membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

5.3.3 JOINTS

Expansion joints shall have dimensions and spacing shown, and be filled with preformed joint filler and sealant. Hold filler in place accurately and securely during the placing and finishing of concrete. Use metal supports to support filler and protect material from damage during concrete operations. A bulkhead, when used, shall have sufficient strength to remain straight from edge to edge of slab when concrete is placed against it. Stake bulkhead in place securely at right angles to longitudinal or transverse axis and surfaces of concrete slab. Space and drive flat metal stakes to hold filler firmly in position. Deposit concrete and compact and strike off before bulkhead is removed. Do not remove stakes until the concrete has been finished. Under no circumstances shall concrete be left above expansion material or across joint at any point. Cut away carefully concrete spanning ends of the joint next to forms after forms are removed.

Fit abutting sections of joint filler material tightly together to prevent concrete from entering expansion joint space.

5.3.4 *Hot Working*

The storage of pressure gas cylinders in basements, stairwells, corridors and escape routes is forbidden. During hot working with inflammable gases hand held fire extinguishers according to DIN EN 3 must be readily available immediately adjacent to the area of working.

6. WALL FINISH

6.1 PART 1 - GENERAL

6.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

6.1.1.1 European Norms and Standards

DIN 18550-3	<u>Plastering and rendering - Thermal insulating rendering systems made of mortar with mineral binder and using expanded polystyrene (EPS) as aggregate</u>
DIN V 18559	Composite systems for thermal insulation; concepts, general description
DIN 4102	<u>Fire behaviour of building materials and elements - Classification of building materials - Requirements and testing</u>
EN 12667	Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance

6.1.2 SUBMITTALS

Submit the following:

Samples

Plaster: Submit four 900 mm panels of varying texture for the Supervisor's approval. After selection of an acceptable texture, construct a sample. The sample wall shall show all aspects of stucco work, including but not limited to, expansion joints, control joints, corner extrusions. The Contractor shall protect the sample wall from damage during the length of the contract.

Natural stone cladding

Manufacturer's Instructions

Submit manufacturer's printed mixing instructions for ready-mix plaster and stucco and acoustical plaster finish.

6.1.3 DELIVERY, STORAGE, AND HANDLING

Deliver manufactured materials in the manufacturers' original unbroken packages or containers which are labelled plainly with the manufacturers' names and brands. Keep cementous materials dry and stored off the ground, under cover, and away from sweating walls and other damp surfaces until ready for use.

6.2 PART 2 - PRODUCTS AND MATERIALS

MATERIALS

6.2.1 THERMAL INSULATION LAYER

Facade thermal insulation will be made up of rock mineral wool panels, with a hard core of high-density mineral wool fibre, thermal conductivity λ_0 0.035 W/mK, coefficient of resistance to vapour diffusion μ 1, delamination > 10 kPa, stress at 10% compacting > 30 kPa, A1 – non combustible material – reaction to fire class.

Installation

It is important that in the case of fire rated panels the fixing details are designed so that the panels are retained in position in the event of a fire. Therefore:

all fixings should be steel and not aluminium,
steel angles/ channels to be a minimum of 1.6mm thick,
all rivets to be stainless steel.

Internal thermal insulation will be made up of rock mineral wool panels, with a hard core of high-density mineral wool fibre, thermal conductivity λ_0 0.035 W/mK, coefficient of resistance to vapour diffusion μ 1, delamination > 10 kPa, stress at 10% compacting > 30 kPa, A1 – non combustible material – reaction to fire class.

Installation

It is important that in the case of fire rated panels the fixing details are designed so that the panels are retained in position in the event of a fire. Therefore:

all fixings should be steel and not aluminium,
steel angles/ channels to be a minimum of 1.6mm thick,
all rivets to be stainless steel.

6.2.2 PAINTINGS

6.2.2.1 Colour and Patterns

Vynil colours and patterns shall be as selected from the manufacturer's standard colour samples. Colours and patterns indicated by reference to manufacturer's name and designations are for colour and pattern identification only and are not intended to limit selection of other manufacturer's products with similar colours and patterns.

6.2.2.2 Ecological painting

The paints employed for interior spaces will be turpentine and high quality pure rubber based; when dissolved in linseed oil they will have to present a shiny surface. The use of rubbers produced by distillation is forbidden.

Water-based wall painting

Water-based paints - aqueous suspensions of inorganic substance, possibly containing glues or synthetic macromolecular substance emulsions.

Tempera - aqueous suspensions of pigments and fillers (lime, chalk, finely powdered calcium carbonate), containing natural or synthetic glues as binders (casein, PVA glue, fish glue). To be exclusively used on pre-treated plastered internal walls. The walls shall be perfectly dry at the time of the paint application. Tempera must possess a good hiding power and must be easily whitewashed

For painting of walls and ceilings, on plaster, ready-mixed plaster, plaster shaving, plasterboard and fire-retardant plaster. Matt acrylic water-based paint based on acrylic resins in water dispersion and light-resistant pigments, unsaponifiable, resistant to weather and industrial agents, washable, permeable to water vapor:

application: by brush, roller or spray,

diluent: water,

application cycle (on new walls): one coat 40% diluted with water, then finishing coat diluted up to 25%,

composition: made from acrylic resin in water dispersion and pigments,

solid content: 33%,

average specific weight: 1.70 kg/l,

average viscosity: 6750 cps at 20° C,

yield: 5-6 sqm per 1 kg (two hands),

dried film thickness: 50 My (two hands),

film appearance: satin,

water vapor permeability: 25 g/m² after 24 h.

6.2.2.3 Sintetic painting

Enamels - composed of natural or synthetic resins, oils, mineral fillers and various oxides pigments. They must possess strong hiding power, ease of application, brightness and impact resistance.

Synthetic resins paints and varnishes- obtained by suspension of pigments and fillers in organic solutions of synthetic resins, may also contain drying agents (oils, acrylic, alkyd, oleo-alkyd, chloro-vynil, epoxy, polyurethane, polyester, chlorinated rubber, silicone). Dry up very quickly to form very hard films. They must be resistant to atmospheric agents, to light, to shock.

Sintetic painting features

Washable water-based paint with high yield, high opacity and hiding power. The presence of various additives protects the walls from mold. Main characteristics:

binding composition - based on acrylic resin emulsion,

aspect of the film - opaque,

specific gravity - 1.64 ± 0.05 kg L at 20 ° C,
viscosity - 7000 ± 1000 cP Brookfield G6 V10 at 20 ° C,
practical coverage - 12-13 m²/L per coat,
resistance to washing - Class 2 UNI EN 13300 ISO11998,
dirty jack - low UNI 10792.

6.2.3 OTHER PAINTINGS

Lime paints - consisting of an emulsion of lime or hydrated lime putty in which inorganic pigments are diluted that do not react with the calcium hydroxide. Adherence to the mortar is improved with artificial or natural glue. Also applicable on freshly plastered walls using natural earth pigments.

Cement paintings - water suspensions of colored cements containing glues. They should be prepared in small quantities because of the fast setting time. The application must be completed within 30 minutes after preparation before the hardening phase. After this phase water dilution for further use shall be forbidden.

Anti-rust and corrosion paint - must be related to the type of material to be protected and environmental conditions. The type of paint will be indicated by the Works Supervisor.

Intumescent paint - able to form films that inflate in the event of fire, producing a porous insulating layer to protect the surface on which they are applied from fire and heat. Must be of the best quality, provided in the original sealed packs and recently prepared. Only to be used only upon precise indications of the Works Supervisor.

6.3 PART 3 - EXECUTION

6.3.1 Surface Preparation Plastering

Clean surfaces before application of gypsum plaster cement plaster or stucco of projections, dust, loose particles, grease, bond breakers, and foreign matter. Do not apply plaster directly to surfaces of masonry or concrete that have been coated with bituminous compound or other waterproofing agents, or that have been painted or previously plastered. Before plaster work is started, wet masonry and concrete surfaces thoroughly with a fine spray of clean water to produce a uniformly moist condition. Check metal grounds, corner beads, screeds, and other accessories carefully for alignment before starting work. Cover all adjacent permanent works which may be soiled during plaster works. Corner beads shall be provided on all corners up to a height of 2m above finished floor level and shall be plastered into position.

6.3.2 PLASTERING

6.3.2.1 *Slump Tests*

Apply Plaster by hand or machine. When a plastering machine is used, control the fluidity of gypsum plaster to have a slump of not more than 75 mm when tested, cement plaster and stucco to have a slump of not more than 65 mm when tested using a 50 x 100 x 150 mm.

6.3.2.2 *Application*

Apply gypsum plaster, cement plaster, and stucco in three coats (two bases and one finish).

Plaster shall not be continuous across expansion and control joints occurring in walls, partitions, and ceilings. Finish work level, plumb, square, and true, within a tolerance of 3 mm in 2500 mm, without waves, cracks, blisters, pits, crazing, discolouration, projections, or other imperfections. Form plaster work carefully around angles and contours, and well-up to screeds. Take special care to prevent sagging and consequent dropping of applications. There shall be no visible junction marks in finish coat where one day's work adjoins another.

6.3.2.3 *Control and Expansion Joints*

Install control joints at locations indicated before applying plaster. Vertical joints must be continuous and butt horizontal joints against the vertical joints. Check expansion, control joints and accessories to ensure unrestrained movement, metal lath not continuous behind the joints, and area between joints do not exceed 14 square meters.

6.3.2.4 *Curing*

6.3.2.4.1 *Cement and Stucco Plaster*

Provide moist curing to the base coat until the application of the finish coat. Immediately before finish coat application, moisten the base coat. For hot, dry, and windy conditions, moisten surface and cover with polyethylene plastic (weighted or taped down) to prevent water loss through evaporation.

6.3.3 **CEMENT PLASTER WORK**

Use cement plaster for interior surfaces which will be subjected to abrasive action, or frequent wetting and for exterior surfaces.

6.3.3.1 *Cement Plaster Thickness Requirements*

Vertical Surfaces

Total Thickness is 13 mm to mm 15 mm

6.3.3.2 *Cement Plaster Base Coat Work*

Apply the scratch coat to cover the base with sufficient material and pressure to form a good bond on the wall and ceiling base. Rake or score horizontally. Apply the brown coat after the scratch coat has been aged at least 24 hours in addition to the moist curing period. Apply the brown coat and float plaster surface to a true, even plane with rod or straightedge to receive the finish coat.

6.3.3.3 *Cement Plaster Finish Coat Work*

After the brown coat has been moist cured for not less than 24 hours and aged at least an additional 5 days, apply the finish coat to a thickness of not less than 3 mm. Where previous coat has become dry, dampen the surface evenly with water, prior to the application of the finish coat.

6.3.4 GENERAL REQUIREMENTS OF INTERNAL PLASTERING

6.3.4.1 *Plastering of metal items*

Window sills, pipes and other such ancillaries shall be plastered in so that damage to the plaster through differential expansion is avoided.

6.3.4.2 *Extent of internal plaster*

Wall plastering shall continue up to the fixed ceiling height and shall be finished cleanly off at the ceiling. Any plaster splattering on the ceiling shall be immediately removed. The same shall apply to floors unless otherwise required by particular flooring systems.

6.3.4.3 *Plaster on Precast ceilings*

Minimum 5 mm plaster, all joints shall be bridged by a joint band. Thin plaster with thickness less than 3 mm is not permitted for use on ceilings.

6.3.4.4 *Clean Hand-over*

Rooms shall be brushed clean before hand-over of plaster works.

6.3.4.5 *Accelerated Drying*

If the Contractor's programme of works requires that mechanical drying units are required to accelerate the drying of plaster then the dryness to be achieved shall be agreed with the Supervisor and a hydrometer to measure moisture.

6.3.4.6 *Plastering in Wet Rooms*

In damp rooms binder material without gypsum shall be used.

6.3.5 GENERAL REQUIREMENTS OF EXTERNAL PLASTERING

6.3.5.1 *Cleaning and Preparation of facades*

Care shall be taken when cleaning of facades with high pressure water that water does not enter the underlying brickwork through cracks or joints in the plaster. When using aggressive additives then all materials susceptible to reaction shall be adequately protected and the water shall be collected at the base of the façade and channelled into a suitable container.

6.3.5.2 *Grading of Strength*

The hard strength of plaster shall be less than the strength of the underground. Working outwards, each layer of plaster shall have a decreasing strength.

6.3.5.3 *Drying between layers*

Each layer of plaster shall be allowed to dry prior to application of the next layer. Normal drying time is taken as 1 day per mm layer thickness.

6.3.5.4 *Inconsistent underground materials*

In situations when the underground consists of different materials then in order to create a homogeneous underground a rough base plaster shall be applied and permitted to harden fully (minimum 1 week) before applying the plaster. Plaster Reinforcement Webbing: Reinforcement webbing shall be alkali resistant and shall be utilised in the centre or outer third of the area.

6.3.5.5 *Plaster over Frames*

Frames of wood or metal shall not be mechanically bonded to plaster or at least shall be cut from the surrounding plaster.

6.3.5.6 *Plaster Reserve for Repair*

At least 10 kg of plaster shall be reserved for small repairs to the façade after the removal of scaffolding.

6.3.5.7 *Consistency of Colour and texture*

Care shall be taken to ensure consistency in colour, texture and thickness of external plaster. Irregularities shall be classified as major defects. If colour in plaster shall be used then care shall be taken that the plaster comes from a single charge.

6.3.5.8 *Skirting Plaster*

Plaster on the skirting around the lower section of facades shall be water repellent.

6.3.5.9 *Reinforcement Webbing*

Reinforcement webbing shall be fixed flat to the surface (no folds). At openings the webbing shall be laid diagonally at the corners of the opening. Over-lapping shall be at least 100 mm. Over-lap at connections with other building elements shall be 300 mm. Webbing shall always be installed at the joint between two materials in the underground and when plastering up to fittings.

6.3.5.10 *Cracks*

Cracks in finished plaster wider than 0,2 mm shall be deemed as defects.

6.3.5.11 *Plaster to match underground*

When selecting the plaster careful consideration of the nature of the underground shall be taken. With new brickwork the Modulus of Elasticity shall not exceed 2500 N/mm².

6.3.5.12 *Rust free tools*

Rust free tools shall be used for spreading the plaster.

6.3.5.13 *Salt Deposits*

Salt deposits on underground shall be removed using a stiff brush (not metal!) after the wall has been permitted to dry.

6.3.6 PATCHING AND POINTING

Cut out and patch loose, cracked, damaged, or defective plaster. Patch shall match existing work in texture, colour and finish flush with previously applied plaster surfaces. Point work abutting or adjoining finish work in a neat manner. Remove droppings or splattering from surfaces. Leave clean and in a condition to receive paint or other finish.

6.3.7 PAINTING WORK

Materials requirements

Paints, water-based paints and enamel must be of recent production, free from sedimentation, thickening, hair, gelatinization. They will be supplied on site in sealed containers bearing the indication of the manufacturer, the type, quality, how to use and conservation of the product, the expiration date. The containers will be opened only at the time of use, and in the presence of the Works Supervisor. The products must be ready to use, after dilution as per manufacturer's indication. They must contribute to the expected surfaces appearance and maintain it in time.

Products for masonry wall painting shall be of non film-former type. Tests will be carried out before and after application, relating to the characteristics of the material: sampling, pigment-binder ratio, grinding fineness, power consumption, drying speed, thickness, resistance to atmospheric agents, chemical agents, to thermal cycles, UV, humidity. In any case, the products to be used must have excellent penetrability, compatibility with the support, guaranteeing good breathability. These features will prevail on the durability of colors.

6.3.7.1 **Surface preparation**

Concrete - for treatment of the walls in concrete and reinforced concrete refer to the related chapter
Iron and steel - for treatment of metal surfaces refer to the related chapter

Plaster, plasterboard - thorough cleaning of the surfaces to be painted, leveling of irregularities with emulsified stucco and sanding. Any presence of oil and grease must be removed by washing the surface with solvent. Preliminary treatment shall be with consolidating primer, 0.2 l/sqm based on special unsaponifiable resins and aliphatic solvents not less than 0.85 Kg/sqm specific weight.

6.3.7.2 **Application cycles and materials**

The method must lead to a uniform application of the paint, technically and aesthetically satisfactory. Before painting starts, notice shall be given to the Works Supervisor to agree on the inspection dates. Paintings showing coagulation or deterioration signs upon container opening will have to be discarded. If a thin skin has formed on the painting it shall be removed before use. Mixing of various components with diluent and/or hardener shall be performed according to the ratio indicated by the supplier. Two component paintings with a limited pot life should be used in the time specified by the manufacturer.

Paintings application may be performed by brush, spray, with or without air, with a combination of these methods according to the instructions of the manufacturer. Application must be performed by experienced operators, the thickness of the various coats of paint should be uniform and the painted surface must be free from brush marks, sagging, discontinuities and other defects. Special care must be taken not to accidentally paint all the works already carried out such as: doors, ceilings, floors, plants, etc. All the painting eventually deposited on these parts should be removed. Special attention shall be paid during application to corners, shutters and hardly accessible areas. The first

coat will be applied within 24 hours after surface preparation. If the surface has been sandblasted it will be preferable to apply the paint within 6 hours, and at any rate before the prescribed cleanliness standards are altered.

6.3.7.3 Weather conditions

The paintings will not be applied during rain, snow, fog or dust blasts, nor under atmospheric conditions that promote condensation or evaporation of the surface to be painted. Traces of moisture must evaporate from the surface within 5 minutes. The painting will not be performed if relative humidity is greater than 85%. When the temperature is below 5 ° C and above 45 ° C the application of paint must be approved by the paints' manufacturer.

6.3.7.4 Application of subsequent coats to the first

Before applying each subsequent coat the previous coat must be completely dried or cured. Before application of each subsequent coat any damage to the previous coats shall be repaired, using the same type of paint. Each new painting layer shall be of different colour than the previous, to avoid missing areas and facilitate inspection.

6.3.7.5 Paintings thickness

Measurements serve to control the thickness of the protective film and the uniformity of the application in its extension. Checks must be performed on wet and dry film. The ratio of wet and dry thickness will be indicated by the Works Executor with sampling. In no area the thickness should be less than what is required.

In the event that the prescribed minimum thickness is not reached in some area a further coat of paint must be applied. The thickness of the paintings must not be higher than the minimum prescribed so as not to affect the appearance or performance of the painting.

6.3.7.6 Cleaning and protection

At the end of each complete application a thorough cleaning of the rooms shall be performed. The works must be protected from accidental impacts and physical-chemical attack.

6.3.7.7 Controls and control systems

Before painting, the Works Supervisor will check that preparation has been performed in accordance with SSPC standards, and that the visual standard corresponds to Swedish Svensks Standard SIS picture standards. The painted surfaces will be subjected to visual examination to control the appearance and continuity of the paintings. Areas where there is a suspicion of porosity or discontinuities of the paintings will be controlled with tools such as the Spark Tester or other appropriate instruments. The wet thickness of the paint can be controlled with appropriate instruments. The dry thickness of the paintings will be checked with instruments such as Microtest or Elcometer or other appropriate instruments. 5 measures will have to be performed (each resulting from the average of 3 readings) in five regularly spaced points for each 10 m² or less area. The average of 5 measures must not fall below the required thickness.

7. FLOOR AND WALL TILING

7.1 PART 1 - GENERAL

7.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

7.1.1.1 *European Norms and Standards*

DIN 18195	Waterproofing of buildings and structures; waterproofing sheeting subjected to hydrostatic pressure from the inside; design and workmanship
DIN EN 87	Ceramic floor and wall tiles - Definitions, classification, characteristics and marking
DIN EN 186-1	Ceramic tiles - Extruded ceramic tiles with water absorption of E between 3% und 6% (Group A IIa)
DIN EN 176	Dust-pressed ceramic tiles with a low water absorption (E up to 3 %) - Group BI
DIN EN 177	Dust-pressed ceramic tiles with a water absorption of E between 3% and 6 % (Group B IIa)
DIN EN 1347	Adhesives for tiles - Determination of wetting capability
DIN EN 12808 (1 to 5)	Adhesives and grouts for tiles - Part 1: Determination of chemical resistance of reaction resin mortars Adhesives and grouts for tiles - Part 2: Determination of resistance to abrasion Adhesives and grouts for tiles - Part 3: Determination of flexural and compressive strength Adhesives and grouts for tiles - Part 4: Determination of shrinkage Adhesives and grouts for tiles - Part 5: Determination of water absorption
DIN EN 13888	Grouts for tiles - Definitions and specifications

7.1.2 SUBMITTALS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

Submit the following samples for approval:

Ceramic floor tile-1000 mm square sheets mounted showing colours, finish, pattern, and form of each type, with joints between the tiles grouted.

Ceramic wall tiles-Sets of four tiles showing size, form, finish, and range and shades in each colour, with joints between the tiles grouted.

Ceramic tile accessories-Pieces of each type, showing colour, finish, type, and style.

Generally products from different manufacturers shall not be used in the same room.

All floors will be made of materials and construction methods corresponding to the current legislation, for the relevant types of floors. All materials must be sampled and submitted for approval to the Works Supervisor, also in relation to permanent color choices. The same material composition, manufacturing period, origin and quality will be used for the whole floors extension. During the pavement laying, walls and all other artifacts must be protected carefully so that no damage is being caused by the works in progress. For the necessary maturation period and in any case for at least 10 days after the conclusion of the work, the Contractor shall supply temporary works barrier designed to prevent the passage on the pavement just built and not yet walkable.

The resilient flooring, textiles and/or hard, sanded and polished, will be protected until the delivery to the Customer with materials (sheets, planks of wood, cardboard, sawdust, etc ...) designed to prevent damage to the surface finish of the completed pavement.

Before delivery to the client, the floors should be washed, dried and polished with special products, according to the instructions of the manufacturer of the materials themselves. No highly concentrated detergents or solvents that have not been recommended and authorized by the Producer and the Works Supervisor shall be utilized.

Floors which may be exposed to run-off by rainwater or by frost, or the effects of heat and solar radiation, shall be adequately protected.

Each type of flooring requires substrates maturation time and coupling of the appropriate surface finish – such periods of time are not reducible beyond certain limits if not at the expense of the strength characteristics of the flooring as a whole.

Where prescribed in the project, and in correspondence of thresholds, steps, discontinuous areas, type of floor changes etc., the edges and the corners of the floors and/or of the substrates must be protected against the risk of chipping with the installation of adequate PVC junction profiles, rubber, normal steel or special steel, or brass, or stone, with characteristics of resistance suitable to withstand the stresses caused by the expected traffic.

Paving screeds and substrates must be realized with inert and binders suitable for the type of pavement required and the benefits to which it must respond. Screeds and substrates will have to present a dry surface, perfectly level or rough (in relation to the required type of surface finish), compact, without cracks or fissures, and dimensionally stable. The floors will have to be uniform in color, depending on the color and the quality required, and free of spots or defects throughout their extension. The final paved surface must be perfectly flat.

Wall coverings of any kind should be perfectly done, with material of choice by the Works Supervisor and in accordance with the provided samples. Special care must be paid in positioning the elements so that they are perfectly adherent to the rear structure and match perfectly with each other; the joint lines will be perfectly aligned. The coatings must be completed with all special finishing elements such as baseboards, strips, frames, etc. After laying completion the wall coverings must be washed and cleaned.

7.1.3 ENVIRONMENTAL CONDITIONS

Do not start tile work unless the ambient temperature in work area is at least 10 degrees C and rising. Maintain the ambient temperature above 10 degrees Centigrade while work is in progress and for at least 3 days after its completion. Do not use adhesives in unventilated areas.

Do not start tile work unless the ambient temperature in work area is at least 10 degrees C and rising. Maintain the ambient temperature above 10 degrees Centigrade while work is in progress and for at least 3 days after its completion. Do not use adhesives in unventilated areas.

If the weather conditions are particularly hostile, or were considered unsuitable for the type of work involved, the Contractor shall proceed with the flooring protection with canopies, towels, mats, etc ... and if this were not enough, in suspending the work with the approval of the Works Supervisor. In hot climates the flooring must be kept wet to prevent too accelerated drying of subfloors. Procedures and methodologies, in this sense, must be coordinated and approved by the Works Supervisor, because a too high amount of water may cause the segregation of the substrate mixture and then the fall of the paving resistance, with a detachment in time. During the laying of the pavement mortar it is not allowed to increase the water content of the substrate, to avoid accelerated drying phenomena.

7.1.4 EXTRA STOCK

Supply an extra two percent of each type tile used in clean and marked cartons.

7.2 PART 2 - PRODUCTS AND MATERIALS

7.2.1 CONCRETE SCREED

The screeds below pavements will be supplied and installed according to good practice and accompanied by data sheets that certify their technical and performance characteristics. The substrate will be realized in two layers. The first will be a lightened concrete screed, CT-C20-F4 type, various thicknesses, placed between the structural slab and the final screed constituted by a cellular concrete bi-component product comprising a cementitious binder and an additive. The mixing must be done with proper machines. The dosage will be 300 kg/m³ of binder and 2 l/mc of additive obtaining a lightened substrate with a compressive strength at 28 days. of 1 N/mm².

7.2.2 CEMENT AND SAND-MORTAR CEMENT

The second layer will be a self-leveling cementitious screed, cement and sand type, various thicknesses. The screed will be fractionated at openings in the walls or any projections, by inserting a separator plate in the screed during installation or fractioning the screed after hardening occurred. After the hardening of the screed must have a compressive and bending strength after 28 days of 20 and 45 N/mm² respectively.

7.2.3 INSULATION

Insulation shall be rock mineral wool panels, with a hard core of high-density mineral wool fibre, thermal conductivity λ_0 0.035 W/mK, coefficient of resistance to vapour diffusion μ 1, delamination > 10 kPa, stress at 10% compacting > 30 kPa, A1 – non-combustible material – reaction to fire class.

Installation

It is important that in the case of fire rated panels the fixing details are designed so that the panels are retained in position in the event of a fire. Therefore:

- all fixings should be steel and not aluminium,
- steel angles/ channels to be a minimum of 1.6mm thick,
- all rivets to be stainless steel.

7.2.3.1 *Insulation Thickness*

Will be provided as necessary to enable thermal resistance. Thickness shall be based on the "R" value for aged insulation. Insulation over steel decks shall satisfy both specified R value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature. Thickness shall be not less 30 mm. Typical thicknesses will be 30, 50, 80 and 100 mm for rock mineral wool panels, 50, 80 and 100 mm for extruded polystyrene foam panels.

7.2.4 TILES

7.2.4.1 **Colour and Patterns**

Tile colours and patterns shall be as selected from the manufacturer's standard colour samples. Colours and patterns indicated by reference to manufacturer's name and designations are for colour and pattern identification only and are not intended to limit selection of other manufacturer's products with similar colours and patterns.

7.2.4.2 **Ceramic Floor-Gres Tile**

All tiles used shall be strictly those approved during the sampling. Mixing of wall or floor tiles from different manufacturers within a single room is not permitted. All floor tiles shall be anti-slip. Tiles shall be lead free.

The tiles will be fine porcelain stoneware, classified in the B1 group according to the UNI EN 87 and meeting all the requirements of the UNI EN 176 standard, consisting of a single mass, even and compact, unglazed or surface treated, obtained for cold pressing of the dry atomized paste derived from a mixture of kaolinite, feldspar and inert minerals of very low iron content.

Cooking temperature	1200°C
H2O absorption	≤ 0,05% UNI EN 99
Flexural strenght	45-55 N/mm2 UNI EN 100
Surface hardnes	7/8 Mohs UNI EN 101
Chemical attack resistance	complyingUNI EN 106
Frost resistance	complyingUNI EN 202
Thermal shock resistance	complyingUNI EN 104
Color stability to light and UV rays	complying DIN 51094
Deep abrasion resistance	125-140 mm3UNI EN 100
Non flammable	

Technical features

CLASSIFICATION ACCORDING TO CEN REGULATIONS B1 EN 176 GROUP					
Feature		Regulation/measu ring method	Measure unit	UNI EN 176	Minimum values
Water absorption %		UNI EN 99	%	≤ 0,5	≤ 0,05
Dimensions (A)	Length and width (B)	UNI EN 98	%	± 0,6	± 0,3
	Thickness	UNI EN 98	%	± 0,5	± 3,0
	Edges straightness	UNI EN 98	%	± 0,5	± 0,3
	Squareness	UNI EN 98	%	± 0,6	± 0,3
	Flatness (C)	UNI EN 98	%	± 0,5	± 0,2

Flexural strenght		UNI EN 100	N/mm ²	≥ 27	45-55
Breaking load	cm 20x20 thickness mm 8,5	UNI EN 100	Kg	Not required	200-220
	cm 20x20 thickness mm 12	UNI EN 100	Kg	Not required	420-460
	cm 20x20 thickness mm 15	UNI EN 100	Kg	Not required	680-720
Deep abrasion resistance		UNI EN 102	mm ³	≤ 205	125-140 mm
Surface hardness		UNI EN 101	MOHS scale	≥ 6	7/8
Linear thermal expansion coefficient		UNI EN 103	Mk ⁻¹	≤ 9	6,5
Thermal shock resistance		UNI EN 103		No sample must show alterations	Complying
Chemical resistance	Domestic use chemical products	UNI EN 106		No sample must show alterations	Complying
	Additives for swimming pools	UNI EN 106		No sample must show alterations	Complying
	Resistance to acids and bases	UNI EN 106		No sample must show alterations	Complying
Frost resistance		EN 202		No sample must show alterations	Complying
Colour stability to light		DIN 51094		No sample must show alterations	Complying

- (A) Reference format cm 30x30
- (B) Acceptable % deviations from average fabrication dimensions
- (C) Center curvature, related to diagonal calculated from the fabrication size

Installation

The tiles laying must be such as to preserve the characteristics that the product itself is potentially able to give the floor. Remove all traces of debris and dust from the laying surface and wet it evenly. Care shall be paid to the preparation of the mortar which forms the screed (maximum thickness 3-5 cm).

The minimum dosage is the following:

washed sand (Ø max 3 mm) - 1 mc,

cement - 325 200 Kg,

water - 80÷100 lt.

The water content, which has to be the bare minimum, can vary depending on the temperature, humidity and sand, the quantity of chemical additives added to the mortar.

Stir the mixture in a mixer or in a mechanical kneading in order to obtain a perfect mixing of the dough and use it in a very short time to make use of the gripping capacity of the binders. It is useful to limit the extent of the surfaces to be laid so that the porcelain stoneware tiles can be laid on a still very moist surface.

Use a vibrating screed for the preparation of the screed so that the mortar is better compacted and the excess quantity of air is removed. Sprinkle with cement 325 in the amount of 5-7 Kg/sqm and wet it before laying of the tiles, to enhance adherence between the tiles and the screed. It is not necessary to wet the porcelain stoneware tiles that are not absolutely porous, but a quick immersion in water may be useful to remove dust.

Lay the tiles edge to edge when applying narrow escape or use the appropriate spacers in the case of wide joints laying: this second installation method is preferable as it helps in case of adjustment

of the structures and allows for tolerable differences in size of the tiles so to ensure a perfect alignment of the joints.

Beat the tiles with a special rubber roller vibrator; the aim is to further compacting the mortar, to increase the contact between the tile and mortar and let emerge the excess water of the mortar. The procedure is valid when lifting a tile the adhesion of the mortar affects at least the 80-90% of the surface. Take care to keep the rubber rollers thoroughly cleaned to avoid damage of the surface of exercise of the tiles.

Grout the joints with cement-based products or with organic-based materials, for example mixtures of epoxy resins loaded with inert and various additives. The joints to be filled must be clean in all their thickness up to the adhesive laying and grouting should be carried out after the adhesive sets (3-4 hours).

Cleaning coatings and flooring from the grouting must be done according to the requirements of manufacturers before they harden permanently, as a belated intervention would require the use of acid solutions which, by direct contact or their vapors effect, may deteriorate the same joints or metal or chrome objects that may be present.

Efflorescences surfaced for water drying, along with the accidental residues of cement mortars, may be removed when the phenomenon will be ceased, with the cautious use of organic acids at low concentration after imbibition with clean water of surface with abundant final rinses.

Expansion joints must be included, partially extended to the substrate, for surface fields not exceeding 30 square meters, in addition to the other structural joints. Small movements with respect to the already pre-existing joints in the support can be made through the interposition of elastic material which allows the relative movements provided without the risk of breaks and/or cracks, and provided the movement is contained within a size not exceeding a fifth side of the tile. Undulations in the flatness of the upper floor above 2 mm per linear meter in length will not be allowed.

With the use of appropriate adhesives tiles may be laid on particular surfaces such as plaster, plastic, metal, wood, panels made of fibers, already existing tiles or in all those cases in which the surface of the structure is slightly porous and it does not provide the traditional anchorage points.

The amount of adhesive necessary for a good pose depends on the flatness of the substrate, the type of prominence at the bottom of the tile and can be estimated at 2,5-4 Kg/sqm for wall cladding and 4-5 kg/sqm for floors; such consumption is far lower than the traditional installation that takes about 25-40 Kg/m of mortar.

Assess the state of the subfloor, which must be perfectly flat, dust-free; evaluate the squareness of the walls, their degree of texturing. Preventively use leveling additives both for walls and for floors in the event that the laying surface is not sufficiently planar. The installation must take place on structures with at least two months of maturation, evaluating the concrete shrinkage in 300-500 microns per meter.

Remove all traces of debris and dust from the laying surface with a vigorous brushing and wet evenly with water and let dry in the presence of highly absorbent surfaces or with very hot, dry climates.

Expansion and desolidarisation joints must be realised along the perimeter walls and the elevation structures, using a strongly compressible material of 0,6-1,2 cm thickness and of appropriate height. Also shrinkage joints shall be realized, so that the laying fields do not exceed 16 sqm each outdoor and 25 sqm indoor.

7.2.4.3 Concrete Floor and Concrete floor tiles

Outdoor concrete floor tiles, self-locking blocks, 50 mm thickness, size and color chosen by the Works Supervisor, with quartz surface finish, including the final sanding with fine sand, including

installation according to the Works Supervisor requests, including cuts, scraps, adjustments in correspondence to cast iron manhole covers, concrete or drains, including transportation charges, loading, unloading and cleaning after installation.

Wear-resistant industrial floor made of concrete conglomerate with guaranteed performance, XC1-XC2 exposure class and minimum Rck 30 characteristic resistance, reinforced with welded mesh consisting of steel rods of 6 mm diameter and FeB44k 20x20 cm mesh. The wear resistant surface layer consists of mineral aggregate corundum quartz, special additives and coloring oxides at a rate of 5 kg/m² (colour according to Works Supervisor indications). The floor must also possess a friction coefficient that complies with the standards for the elimination of architectural barriers in buildings, public spaces and services. The processing will include formation of the slopes, deep cutting and PVC elastic joints forming 4x4 m elements and anyway not exceeding 20 sqm, expanded polystyrene strips (10 mm) perimeter insulation against the walls for an appropriate protection up to 1 m height, the laying of angular steel profile in correspondence of the thresholds, the final sanding, painting with suitable detergents, rinsing with excess water absorption with suitable systems.

7.2.4.4 Wall tiles

Glazed Majolica ceramic tiles: standard grade
Nominal Facial Dimensions of 200 by 200 mm, 13

Provide in the following areas: WC

Mounted tile for use in wet areas

For wall cladding, appropriate expansion joints at the edges and corners shall be realized (additional joints along the string courses shall be included for outdoor applications). For surfaces such as gypsum plaster, gypsum panels, prefabricated plasterboard, chipboard, asbestos cement, plaster, precast concrete, etc. a permanently elastic paste adhesive must be utilized. A preventive treatment with an insulating primer shall be foreseen before using a cement adhesive on plaster or plaster containing gypsum.

For the various components mixing carefully follow the manufacturer's instructions; in case of cement-based adhesive (the most used) mix thoroughly with clean water in a proportion of 25-30% by weight, to obtain a homogeneous mixture free of lumps. Allow to stand for 10-15 minutes then stir again.

Spread the adhesive with a spatula with the appropriate profile in such a way as to spread the adhesive at the back of the tile for at least 80-90% of the surface.

In case of two components polyurethane adhesives the tiles must be absolutely dry; in case of cement-based adhesive powder or paste it is not necessary to wet the tiles before installation (only wash them in clear water when excessively dusty).

Spread the adhesive on small surfaces (about 2 square meters at a time) and then lay the tiles on the still fresh adhesive. In case the adhesive formed a light skin, reactivate the surface using the notched trowel. Lay the tiles edge to edge when applying narrow escape or use the appropriate spacers in the case of wide joints pose.

Small defects of installation, such as dents or uneven joints, can be easily removed during the recording time allowed by the adhesive. Grout the joints between tile and tile with suitable filler.

7.2.4.4.1 Trim Units

Provide matching trim units with tile work. Provide where indicated for a complete and finished installation. Provide bullnose units for wainscots, except where wainscot is flush with abutting wall

surface. Provide up-and-down corners with bullnose units where there is a break in wainscot height, or where the wainscot does not terminate against projecting construction. Internal corners shall be squared and external corners rounded using appropriate matching trim units.

7.2.4.5 *Aggregate*

Sand for grout shall pass a number 16 sieve.

7.2.5 *Water*

Clean, portable.

7.2.5.1 *Portland cement*

White for grout, grey for other uses.

7.2.5.2 *Metal Dividing Strips*

Heavy-top terrazzo type, brass or zinc alloy, approximately 2 mm thick with 6 mm thick top, and depth equal to thickness of tile plus setting bed.

7.2.5.3 *Thresholds-Skirting*

Hard, sound, domestic marble, minimum 25 mm thick for mud bed application and 13 mm thick for thin-set application, unless indicated otherwise. Round edges exposed to foot traffic. Sand-rubbed finish on exposed surfaces. Bevel vertical edges to maximum of 13 mm in height or as indicated.

7.2.5.4 *Mortars and Grouts*

7.2.5.4.1 *Mortar Tile Setting*

Portland cement mortar

Dry-set Portland cement mortar -factory sanded.

Organic adhesive -The use of organic adhesives is limited to wall applications

7.2.5.4.2 *Grout*

Commercial Portland cement

Sand Portland cement

Tile-setting and grouting epoxy.

Non staining

Environmentally neutral

7.3 PART 3 – EXECUTION

7.3.1 EXAMINATION

Do not start tile work until roughing in for plumbing, heating, ventilating, air conditioning, and electrical work has been installed and tested; and built-in bathtubs, shower stalls, and membrane waterproofing have been installed and tested.

7.3.2 PREPARATION

7.3.2.1 *Underground Preparation*

Do not begin floor tile installation in areas receiving wall tile until wall tile installation has been completed. The bedding shall be chosen to suit the underground.

7.3.2.2 **Bedding on concrete floor**

Prepare with mortar setting bed before applying tile with dry set mortar. Fill areas where the floor does not meet the required tolerances and level. Provide expansion joints where indicated.

7.3.2.3 **Preparation of Mortar Mixes**

Measure mortar materials in approved containers to ensure that proportions of materials will be controlled and accurately maintained. Measuring materials with shovels is not permitted. Unless specified otherwise, mix mortar in proportions by volume in approved mixing machines or mortar boxes. Control the quantity of water accurately and uniformly.

7.3.2.4 **Salt deposits on Walls**

Salt deposits on underground shall be removed using a stiff brush (not metal !) after the wall has been permitted to dry.

7.3.3 INSTALLATION

7.3.3.1 *Floor Tiles*

Portland cement mortar: Recess, or depress setting bed where indicated. Tiles shall not be laid on cement screed with a moisture greater than 2%.

7.3.3.2 *Wall Tile*

Wall surfaces to receive ceramic tile, set in a mortar setting bed shall have square corners, be plumb and true, with variations not exceeding 2,5 mm per meter from the required plane.

Portland cement mortar or organic adhesive.

7.3.3.3 *Joints*

Make parallel, plumb, level, and in alignment. Make end joints in broken-joint work on centre lines of adjoining tiles, as far as practicable. Set square tiles with straight joints, and set oblong tiles with broken joints. Jointing shall only be made following the setting of the bedding mortar

7.3.3.3.1 Joint Width

Make joints uniform in width and space to accommodate tile with a minimum of cutting, but maintain standard mounting widths between units abutting sheets of mounted ceramic mosaic tile. Generally joint widths in wall tiling shall not exceed 3 mm. Make joint widths as follows:

Mounted tile: As determined by the mounted tile spacing.

Un-mounted Glazed Wall Tile: As determined by spacing lugs.

Quarry tile: 6 mm minimum, width of 10 mm maximum.

Trim units and accessories: Match adjoining tile units.

7.3.3.3.2 Grouting and Pointing Joints

Provide expansion and control joints in tile.

Install expansion and control joints as follows:

Insert preformed joint filler or back-up material in joints to proper depth to provide correct cavity depth for sealant.

Prior to grouting, keep joints open and clean by stuffing with paper or other material to prevent filling with dirt, grout, or mortar.

After tile is grouted and completely dry, remove paper or other temporary filler material; brush joints clean and fill with back-up material and sealant

7.3.3.4 *Metal Dividing Strips*

Install dividing strips in mortar setting bed while bed is in a plastic state. Set dividing strips where indicated in straight, unbroken lines, flush with unfinished floor surface. Provide dividing strips at joints where floor tile abuts and is flush with other types of floor finishes, except at doors where thresholds are provided.

7.3.3.5 *Thresholds*

Align edges with faces of trim on both sides of openings. Fit thresholds neatly and bed properly in cement mortar flush with adjoining floors.

7.3.3.6 *Joints to Fixtures*

The joint between wall or floor tiles and fixtures (e.g. bathroom fitting) shall be made water tight and elastic where not otherwise specified. Floor gullies shall be fitted with sealing rims and tiles around the gullies shall be laid to a slight fall.

7.3.3.7 *Elastic Joints*

Elastic joints shall be installed at all points where tiling crosses underground of different materials: Elastic joint are also required at returns in the tiling. Edges of joints shall be primed and surfaces covered using adhesive tape. Joints shall be free from grout deposits. Elastic fillers shall be compatible with both the tiles and underground. In staircases, elastic joints shall be provided between stair tiles and skirting tiles.

7.3.3.8 *Sealing under Fixtures*

Sealing shall be provided under baths and shower bases.

7.3.3.9 *Tiling in Wet Areas*

When tiling in wet areas care shall be taken that no voids in the bedding are formed.

7.3.3.10 *Laying Pattern Geometry*

Generally tiles shall be laid parallel to walls unless otherwise stipulated. Where possible joints of floor tiles shall be continuous with wall tile joints. The Contractor shall confirm his intentions to the Supervisor prior to commencing tiling works. If tiles are grooved on the underside then all tiles shall be laid with the grooves orientated in the same direction.

7.3.3.11 **Use of Cut Tiles**

Only tiles larger than half the size of the main tile may be used. The use of small fill pieces of cut tile shall be avoided.

7.3.3.12 **Expansion Joints**

Expansion joints shall be provided at least every 4m.

7.3.3.13 **Corner trim units**

All visible corners in wall tiling shall receive a trim unit unless glazed corner tiles are specified.

7.3.4 **CLEANING**

Upon completion of tiling works in any one room the room shall be brushed clean, waste material and excess mortar removed.

Acid cleaning of unglazed tile when necessary, shall be done no sooner than 14 days after setting tile.

When grinding tools are used for dry cutting then vacuum dust removal shall be adopted.

7.3.5 **PROTECTION**

During tiling works all floor gullies etc. are protected from ingress of grout, deposits etc.

Cover finished tile floors with clean, 1.45 kilogram/sq m natural craft paper before permitting foot traffic.

Place board walkways on floors that are to be continuously used as passageways by workers. Cover marble stools and thresholds with boards.

Protect tiled corners, external angles, with board corner strips in areas used as passageways by worker

8. **CEILING FINISHING**

8.1 **PART 1 - GENERAL**

8.1.1 **REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

8.1.1.1 *European Norms and Standards*

DIN 1748	Glass in building - Special basic products - Part 1: Borosilicate glasses Glass in building - Special basic products - Part 2: Glass ceramics
DIN 18168-1	Lightweight ceiling linings and counter ceilings
DIN 4102	Fire behaviour of building materials and elements - Classification of building materials - Requirements and testing
DIN EN 485-1	Aluminium and aluminium alloy sheet, strip and plate; technical delivery conditions
DIN EN 1396	Aluminium and aluminium alloys - Coil coated sheet and strip for general applications - Specifications
ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
VDI 3755	Sound insulation and sound absorption of suspended ceilings

8.1.2 SUBMITTALS

Submit the following

Shop Drawings

Product Data

Samples

Suspension system

Show suspension system, methods of anchoring and fastening, and ceiling plan.

Two samples of each type of suspended unit showing texture, finish, and colour.

Certificates

Fire endurance

Test certification and reports

8.1.3 DELIVERY AND STORAGE

Deliver units in the manufacturer's original unopened containers with brand name and type clearly marked. Handle materials carefully and store them under cover in dry, watertight enclosures. Immediately before installation, store units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed.

Samples of the materials to be laid will be supplied in the types envisaged by the project, accompanied by certificates proving they meet the requirements. Before ordering of materials, samples must be approved by the Works Supervisor. The correct arrangement of the partitions will be tested in advance and agreed with the Works Supervisor before tracings.

8.1.4 ENVIRONMENTAL CONDITIONS

For 24 hours before, during, and 24 hours after installation of units, maintain temperature and relative humidity at typical in-service conditions. Interior finish work such as plastering, concrete, and terrazzo work shall be completed and dry before installation. Relative humidity shall be less than 80% . Mechanical, electrical, and other work above the ceiling line shall be completed and approved prior to the start of ceiling installation.

8.2 PART 2 - PRODUCTS

8.2.1 PLASTERED CEILINGS

See chapter 11

8.3 PART 3 - EXECUTION

8.3.1 PLASTERED CEILING

See chapter 11

9. PAINTS AND COATINGS

9.1 PART 1 - GENERAL

9.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced.

- Applicable Albanian Laws and Norms
- *European Norms and Standards*

9.1.2 SUBMITTALS

Submit the following

Shop Drawings

Product Data

For each type of coating, sealant, or other product furnished, submit data from the manufacturer's paint laboratory indicating that the product conforms to requirements of the referenced

Samples

Manufacturer's Instructions

Certificates

9.1.3 QUALITY ASSURANCE

9.1.3.1 *Field Samples and Tests*

The Supervisor reserves the right to take 0.5 litre samples of paints at random from the products delivered to the site and test them to verify that the products either conform to the referenced specifications or the approved substitution. Products which do not conform shall be removed from site and replaced with new products that conform to the referenced specification or the approved substitution.

9.1.4 PACKAGING, LABELING, AND STORAGE:

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, colour, quantity, date of manufacture,

manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer.

9.1.5 ENVIRONMENTAL CONDITIONS

9.1.5.1 *Exterior Coatings*

Do not apply coating to surfaces during foggy, rainy weather or strong direct sunlight. The creation of shading using tarpaulins etc. shall be permitted only with the permission of the Supervisor.

9.1.5.2 *Interior Coatings*

Apply coatings when surfaces to be painted are dry

9.2 PART 2 - PRODUCTS

9.2.1 MATERIALS

Paint and coating systems shall be complete so that all primers, thinners toners etc. recommended by the manufacturer are included in order to ensure a complete system.

Colours shall be taken from the Project Specific Specification or rather agreed with the Supervisor.

9.2.1.1 **Primer Coating, (Exterior), one coat**

Primer Coating, (Interior), one coat

Water Paint, Acrylic with quartz flour (Exterior) two coats

Water Paint Vinyl (Interior) two coats

Emulsion (Interior) two coats

Rust proofing, red oxide of lead in boiled linseed oil, two coats

Enamel Painting, (oil-synthetic enamel) for metal surfaces, two coats

Thinners as specified by the coating manufacturer

Paint stripping Spirits shall be FCKW free

9.2.1.2 **Emulsion paints**

Emulsion paints shall be free of organic sprits, toxic conservatives, toxic fungal and algaecides, emission free, porous and shall have an equivalent permeability of $sd \leq 0,02m$.

9.2.1.3 **DIRECT 3 in 1 High Resistance Enamel Paint and Antirug for Metal**

Direct 3ne1 is a glossy paint and at the same time a metallic liner, with fast drying and anti-change. It is suitable for painting new and old metal surfaces (stretched), without using primer before. It has a long life, strong adhesion and protects metals in the long run against change. It has very good working and leveling properties as it does not leave brush marks on the surface.

9.2.1.4 **ROOF DRAIN**

Roof drain must have the following features:

- Pleasing dome shape with a low profile and adequate free drainage area

- Corrosion-resisting dome material
- Effective debris protection
- Overflow drainage to allow drainage during debris build-up
- Gravel stop
- Positive Flashing Clamp
- Seepage control channels
- Sump designed to minimize air entrapment
- Flexibility to meet all construction requirements Smith roof drains include all of these features.

9.3 PART 3 - EXECUTION

9.3.1 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, and other substances deleterious to coating performance. The underground shall be prepared to ensure the final quality of the coating are met. Small defects in plaster in wet rooms shall only be filled with non-gypsum based materials. In cases where the underground is considered unsuitable the Supervisor shall be immediately notified.

9.3.1.1 *Preparation of metal surfaces (including metals parts of door, windows etc.)*

9.3.1.1.1 Ferrous Surfaces

Brush-off blast and clean entire surface. Water jetting to may be used to remove loose coating and other loose materials.

Galvanized Surfaces with Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution.

9.3.1.1.2 Aluminium, Other Non-Galvanized, and Non-Ferrous Surfaces

Surface Cleaning: Solvent clean in accordance and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants. Surfaces shall be roughened.

9.3.1.2 *Preparation of concrete and cementsurface*

9.3.1.2.1 Concrete and Masonry

Remove the following deleterious substances: Dirt, Grease, and Oil. Wash surfaces. Plastered surfaces shall be brushed using a copper brush prior to painting. Plaster imperfections shall be removed prior to painting.

9.3.1.2.2 Gypsum Board, Plaster, and Stucco

Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material.

9.3.1.3 *Preparation of existing painted surfaces*

Existing painted surfaces shall be prepared so that adequate bonding occurs. Cracked paint shall be removed or sanded so that the defects are not visible after painting.. Paint on elastomeric seals shall not be renewed. Lime and oil based paints shall be removed and shall not be painted over. Removal of paint by heat requires the permission of the Supervisor.

9.3.1.4 *Façade Cleaning*

The Contractor shall carryout a test clean for approval by the Supervisor prior to commencing with the cleaning works. Permanent works shall be suitable protected during cleaning works.

9.3.2 APPLICATION

9.3.2.1 *Coating Application*

Apply coating materials in accordance with manufacturer's instructions.

Thoroughly work coating materials into joints, crevices, and open spaces. Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats.

Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.

Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colours.

9.3.2.2 *Equipment*

Apply coatings with approved brushes, approved rollers, or approved spray equipment, unless specified otherwise. Spray areas made inaccessible to brushing by items such as ducts and other equipment.

9.3.2.3 *Thinning of Paints*

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory for the type of paint being used. Obtain written permission from the Supervisor to use thinners. The written permission shall include quantities and types of thinners to use.

9.3.2.4 *Coating Systems*

Systems by Substrates:

Apply coatings that conform to the respective specifications listed in the following points:

Exterior Metal Surfaces

Interior Metal Surfaces

Exterior Concrete, Concrete Masonry, Plaster

Interior Concrete, Concrete Masonry, Plaster

Exterior Wood Surfaces

Interior Wood Surfaces

Minimum Dry Film Thickness (DFT):

Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 0.0375 mm each coat unless specified otherwise. Coating thickness where specified, refers to the minimum dry film thickness.

Utilised Product List:

The Contractor shall submit a detailed list of all coatings and paints used following completion of the work. This list shall include use, manufacturer, product reference, supplier & charge number of the materials to enable the Beneficiary to re-order materials for maintenance purposes.

Reserve for touch-ups:

The contractor shall present the Supervisor with a reserve of each coating used in original colour to permit touching up of small damages which may occur before handing over the building. These reserves are included in the Contractor's price unless the quantity required exceeds 10% of the original container or 10 kg by silo delivered paints.

9.3.3 COATING SYSTEMS FOR METAL

The Supervisor may request that multiple coatings of corrosion protection coatings are applied in different tones to enable the verification of the number of coats.

EXTERIOR METAL SURFACES

Rust proofing: 0.50 mm

Intermediate: semi-gloss 0.0375 mm

Topcoat: semigloss 0.0375 mm

INTERIOR METAL SURFACES

Rust proofing - 0.050 mm

Intermediate: semigloss 0.0375 mm

Topcoat: semigloss 0.0375 mm

9.3.4 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

9.3.4.1.1 EXTERIOR

Primer: 0.0375 mm

Intermediate: (flat) 0.0375 mm

Topcoat: (flat) 0.0375 mm

9.3.4.1.2 INTERIOR

Primer:, 0.050 mm

Intermediate:, semi-gloss 0.0375 mm

Topcoat:,semi-gloss 0.0375 mm

PROTECTION

Protection of Permanent Works

The Contractor shall cover and mask all items in the area of the works to protect them from being soiled by paint. Any soiling shall be immediately removed. Floors shall also be protected.

Storage of flammable materials

The storage of flammable materials on site shall be discussed agreed with the Supervisor.

Removal of stored materials

Rooms used for storage of Contractor's materials shall be cleared of stored materials, brushed clean and handed over within a maximum of three days following the request by Supervisor.

Protection of Glass and Aluminium

When using lime based paints glass and aluminium shall be carefully protected.

Protection of Seals

Seals to door and windows etc. shall be removed where practicable prior to painting works and reinstalled upon completion. Removed seals shall be labelled and carefully stored so that their reinstallation in the original position is secured. Where this is not practical then the seals shall be protected using masking tape.

Functionality of fittings

Protection of items such as door handles, window opening mechanisms etc. shall not impinge on their-functionality.

Removal of surplus material

All surplus materials shall be removed from site unless otherwise stipulated by the Supervisor.

Early coating of concealed parts

Items which will be concealed by advancing construction which however require coatings shall be painted prior to their concealment. The Contractor is prepared to coordinate such work with the Supervisor even if it means early or interrupted presence on site.

Masking Tape

Masking tape shall be suitable for the surface upon which it shall mask. Material reactions shall be avoided. If in doubt tests shall be made on non-visible parts of the surface.

Unsuitable surfaces

The following surfaces are considered unsuitable for painting and shall be masked during painting works:

Foams

Elastomeric seals

Polyamide, Soft PVC, Polyvinylchloride

Polycarbonates

Polyethylene

10. DOORS

10.1 PART 1 - GENERAL

10.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

10.1.1.1 *European Norms and Standards*

General

DIN 18101	Doors; doors for residential buildings; sizes of door leaves, position of hinges and lock, interdependence of dimensions
DIN 68121-1/2	Timber profiles for windows and window doors; dimensions, quality requirements
DIN 68706-1	Interior doors made from wood and wood-based panels - Part 1: Door leaves; Concepts, sizes, requirements
DIN 18203-3	Tolerances for building; building components of timber and wood based panel products
DIN 18111	Door frames - Steel door frames - Part 1: Standard door frames for rebated doors in masonry

Doors

DIN EN 1522	Windows, doors, shutters and blinds - Bullet resistance - Requirements and classification
DIN EN 12051	Building hardware - Door and window bolts - Requirements and test methods
DIN EN 12207	Windows and doors - Air permeability - Classification
DIN EN 12208	Windows and doors - Water tightness - Classification
DIN EN 12210	Windows and doors - Resistance to wind load - Classification
DIN 18095-1	Smoke control doors; concepts and requirements
DIN 18093	Fire barriers; installation of fire doors in fireproof masonry or concrete walls; position and shapes of anchorages, installation
DIN 68706-1	Interior doors made from wood and wood-based panels

Steel

DIN EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
DIN EN ISO 12944-5	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 5: Protective paint systems

Wood

DIN EN 300	Oriented Strand Boards (OSB) - Definitions, classification and specifications
DIN EN 313	Plywood - Classification and terminology - Part 1: Classification Plywood - Classification and terminology - Part 2: Terminology
DIN EN 385	Finger jointed structural timber - Performance requirements and minimum production requirements
DIN EN 636	Plywood - Specifications
DIN EN 13986	Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking

Ironmongery:

DIN 18263	Building hardware - Controlled door closing devices with hydraulic damping
DIN EN 179	Building hardware - Emergency exit devices operated by a lever handle or push pad - Requirements and test methods
DIN EN 1125	Building hardware - Panic exit devices operated by a horizontal bar - Requirements and test methods
DIN EN 1158	Building hardware - Door coordinator devices - Requirements and test methods
DIN EN 12020-2	Aluminium and aluminium alloys - Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 - Part 2: Tolerances on dimensions and form
DIN EN 12365-1	Building hardware - Gaskets and weather-stripping for doors, windows, shutters and curtain walling - Part 1: Performance requirements and classification

10.1.2 SUBMITTALS

All openings shall be measured by the Contractor prior to issuing the following:

10.1.2.1 Submit the following

Shop Drawings

Doors

Submit drawings or catalogue data showing each type of door unit with installation instructions.

Product Data

Accessories

Sample warranty

Sound transmission class rating

Fire resistance rating

10.1.2.2 Samples

Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door finish colours;

- Submit a minimum of three colour selection samples for selection by the Supervisor.

10.1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of 100 mm thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity. Do not store in a building under construction until concrete, masonry work, and plaster are dry. Replace defective or damaged doors with new ones.

10.1.4 WARRANTY

Warranty shall warrant doors free of defects as set forth in the manufacturer's standard door warranty.

10.2 PART 2 – PRODUCTS

All doors shall be provided in accordance with the door schedule provided in the drawings.

10.2.1 INTERNAL AND EXTERNAL DOORS

10.2.1.1 General

The Contractor shall certify the conformity of the offered product with the specifications and shall furnish the employer and the Supervisor/architect with further certifications that prove the conformity of the goods with the standards of the European Committee.

For the installation of the system under this chapter, the contractor shall submit to the Supervisor a complete installation design including calculations and equipment as described under these technical specifications. The design shall be in accordance to the detailed design. All design and purchase shall be approved by the Supervisor/architect and the employer. Only specially skilled and

licensed technicians are authorised to install the system. The contractor shall provide to the Supervisor/architect evidence of the qualifications of the erection staff before commencement of works.

Provide wood doors of the types, sizes, and designs indicated in the drawings.

The sizes of the doors vary and depend by architectural composition, and the requirements of the designer.

The doors can be made in wooden, metal and aluminium etc.

The doors main parts are:

1. the sub-frame to be fixed to the wall by mean of proper steel clamps before plastering; (the sub frame can be in wooden, metal or aluminium)
2. the frame to be screwed to the sub-frame after plastering and painting;
3. the door can be in wooden, metal and aluminium supporting by mean of solid strips or steel and other accessories including steel clamps, hinges, lock anchors, screws, handles.

Following basic requirements shall be also fulfilled:

Transom/ mullion constructed in steel or aluminium profiles

All steel profiles to be galvanised (inside and outside) and coated

All aluminium profiles shall be coated

Thermally separated profiles shall be as material group 1.0 with 5 thermal chambers

Profile form suitable for structural glass with opening panels including seals in EPDM, absolute weatherproof.

Exterior clamping profiles with visible hexagonal V2A screws and cover profiles – horizontal as U profile and vertical as H profiles.

Provisions for sufficient draining of condense water

Profile Dimensions:

Internal visible width on window panels approx. 50 mm

External visible width of clamping profiles approx. 50 mm

Visible width of Transoms approx. 50 mm

Front edge of doors (or rather frames) shall be flush with clamping profiles.

Profile cross sections shall be according to the structural calculations.

Grid pattern and all fill elements according to detailed drawings.

The parts of door are depending by the kind and material of doors. The parts of doors will be for each type of doors as follows:

- A wooden sub-frame with seasoned Pine wooden (width 3 cm), to be fixed to the wall by mean of proper steel clamps before plastering
- A wooden frame to be screwed to the sub-frame after plastering and painting. Following the doors design shown in Technical Drawing, the frame will be provided by hinges and lock anchors for all kinds of doors.
- Opening MDF panels that are made up in wooden case (minimum size 10 x 4 cm) and horizontal and vertical parts every 40 cm. In under part of doors, the panels will be minimum 20 cm over the under part of doors.
- Hinges in three anchor points (minimum 3 hinges per each part) with minimal length $l=16$ cm should complete the amour -plate doors.

- A metallic lockset with three copies of keys type Yale or similar, door handles and push handle
- Hinges in three anchor points (minimum 3 hinges per each part) with minimal length $l = 16$ cm should complete the amour -plate doors.

10.2.1.2 Aluminium Doors

Supplying and fixing of aluminium doors as described in the Technical Drawings and which dimensions will be taken by the Contractor, made up in aluminium alloy profiles according to European Standards EN 573 - 3 and duly pre-painted. Colour will be according to the request of Investor.

The fix frames will have a depth of 61-90 mm. They are provided with elements for fixing and anchorage to wall structures as well as jutting parts enabling the sliding of sashes; profile shape is tubular in order to house assembling accessories. Frame profiles will fit with a cover profile overlapping the wall by 25 mm. Mobile frame profiles have a depth of 32 mm and a height of 75 mm with flat or ornamental solution.

Both fix or mobile frames are designed to build thermal break door and are made up of two aluminium profiles which are joined one another by means of two 15 mm insulating lists made of plastic materials. Thermal break is obtained by inserting 15 mm long and 2 mm thick polyamide strips strengthened with fibre glass.

The profile is designed with a hollow central part for the insertion of the corner joint bracket (with space for 18 mm high glass housing) and the trolleys for their sliding.

Seal is assured by brushes with stiff central fin. The characteristics of seal against atmospherically agents obtainable by these sections must be provable by the certificate of testing affected by the window frame manufactures or by the profiles producer. The aluminium sections will be painted by a bake lacquering process. The temperature must not exceed 180 degrees; the baking time will be less than 15 minutes. The lacquering thickness should be at least 45 μ . The powders used will be made up of high quality acrylic resins or linear polyesters.

A solid sub-frame will be carefully fixed with steel clamps to the walls by means of cement mortar (no screw sockets). The fixing must preferably have a distance from the frame corners of no more than 150 mm and between them of no more than 800 mm.

The fixed door frame will be screwed to the sub-frame when all plastering and painting works finished. Opening glassed panels will be hinged to the doorframe and will be supplied by a three point anchored lock and handle. Using plastic-elastic materials, after having filled any gap with insulating materials, will carry out the sealing between the cases and the building context. Between the inside of the steel frame support and the outside of the aluminium fix frame it is preferable to keep an installation tolerance of 6 mm, considering a protrusion of the fixing spacers of about 2 mm. Dimensional tolerance and thickness will be according to EN 755 – 9.

Door opening made up by standard aluminium profiles and internal by- laminated wooden panel 100 mm thick min.

A metal lock and Yale type key in 3 copies, brass door handle and push-plate.

As above but with glass panels as described in the Technical Drawings. The glass double panels could be transparent (4-6-4mm thick min) or wire-net reinforced (6mm thick min.)

As above but with highlight. The upper part of some of the internal doors to the corridors where indicated in Technical Drawings will have highlight openings, supplied by glass panels reinforced by wire-net.

Samples must be submitted to the Supervisor for a previous approval before fixing.

10.3 PART 3 - EXECUTION

10.3.1 INSTALLATION

10.3.1.1 Frames

Set frames, plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed. After erection and glazing, clean and adjust hardware.

10.3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames, prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

10.3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly remove mastic smears and other unsightly marks.

11. WINDOWS

11.1 PART 1 - GENERAL

11.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only:

11.1.1.1 *European Norms and Standards*

- DIN 4102-18 Fire behaviour of building materials and components; fire barriers, verification of automatic closure (continuous performance test)
- DIN 4108 Thermal insulation and energy economy in buildings
- DIN 4109 Sound insulation in buildings; requirements and testing
- Seals
- DIN 7863 Non cellular elastomer glazing and panel gaskets; technical delivery conditions
- DIN 18540 Sealing of exterior wall joints in building using joint sealants
- DIN 18545 Glazing with sealants; rebates; requirements
Sealing of glazing with sealants - Part 2: Sealants, designation, requirements, testing
- DIN 52460 Sealing and glazing - Terms
- Glass
- DIN EN 356 Glass in building - Security glazing - Testing and classification of resistance against manual attack

- DIN EN 1063 Glass in building - Security glazing - Testing and classification of resistance against bullet attack
- DIN 1286 Sanitary tap ware - Low pressure mechanical mixing valves; general technical specification
- DIN 18056 Window walls; design and construction
- DIN 18232 Smoke and heat control systems - Part 1: Terms, safety objectives
Part 2: Natural smoke and heat exhaust ventilators; Design, requirements and installation
Part 4: Heat exhaust systems (WA); Test methods
Part 5: Powered smoke exhaust systems; Requirements, design
Powered smoke exhaust systems - Part 6: Requirements for components and suitability testing

Ironmongery

- DIN EN 1202 Chemicals used for treatment of water intended for human consumption - Di-potassium hydrogen orthophosphate
- DIN EN 1935 Building hardware - Single-axis hinges - Requirements and test methods
- DIN EN 12020 Aluminium and aluminium alloys - Extruded precision profiles in alloys EN AW-6060 and EN AW-6063
Part 1: Technical conditions for inspection and delivery
Part 2: Tolerances on dimensions and form
- DIN EN 12365 Building hardware - Gaskets and weather stripping for doors, windows, shutters and curtain walling
Part 1: Performance requirements and classification
Part 2: Linear compression force test methods
Part 3: Deflection recovery test method
Part 4: Recovery after accelerated ageing test method

Windows

- DIN EN 1522 Windows, doors, shutters and blinds - Bullet resistance - Requirements and classification
- DIN EN 12051 Building hardware - Door and window bolts - Requirements and test methods
- DIN EN 12207 Windows and doors - Air permeability - Classification
- DIN EN 12208 Windows and doors - Water tightness - Classification
- DIN EN 12210 Windows and doors - Resistance to wind load - Classification
- DIN 18055 Windows; air permeability of joints, water tightness and mechanical strain; requirements and testing
- DIN EN 573 Aluminium and aluminium alloys - Chemical composition and form of wrought products

11.1.2 CERTIFICATION

Each prime window unit shall bear the Label warranting the product. Certified test reports attesting that the prime window units meet the requirements, including test size, will be acceptable in lieu of product labelling.

11.1.3 SUBMITTALS

Submit the following:

Product Data of windows, accessories, screens

Finish Sample

Window Sample

Design Data

Structural calculations for deflection

Test Reports:

Air infiltration

Water infiltration

Thermal & Sound Insulation Classification

Mullion and transom bar wind load

Operation and Maintenance Data

Windows, Data Package

11.1.4 QUALITY ASSURANCE

11.1.4.1 *Shop Drawing Requirements*

Drawings shall indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weather-stripping, method of attaching screens, material and method of attaching sub frames, casings, sills, trim, anchors, installation details, and other related items.

11.1.4.2 *Sample Requirements*

11.1.4.2.1 Finish Sample Requirements colour coating is to be provided.

11.1.4.2.2 Window Sample Requirements

Submit one full-size window of each type proposed for use, complete with label, glazing, hardware, anchors, and other accessories. Where screens or weather-stripping is required, fit sample windows with such items that are to be used. After approval, install each sample in work, clearly identified, and record its location.

11.1.4.3 *Design Data Requirements*

Submit calculations to substantiate compliance with deflection requirements. Calculations shall be provided by a Professional Supervisor.

11.1.4.4 *Test Report Requirements*

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified.

11.1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the site. Store windows and components out of contact with the ground, under a weather tight covering, so as to prevent bending, warping, or otherwise damaging the windows. Damaged windows shall be repaired to an "as new" condition as approved. If windows cannot be repaired, provide a new unit.

11.1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

11.2 PART 2 - PRODUCTS

11.2.1 WINDOWS

Prime windows shall comply with the requirements specified herein, Window framing members for each individual lit of glass shall not deflect to the extent that deflection perpendicular to the glass lit exceeds tolerances when subjected to uniform loads at specified design pressures. Structural calculations for deflection shall be provided to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weather stripping, screens, and accessories to be furnished. Each window shall be a complete factory assembled unit with or without glass installed. Dimensions are shown in window schedule included in the drawings.

11.2.1.1 *Windows Sills*

The sills in marble, 3 cm thick min., with colour and long according to the request of Supervisor and Technical Drawings. Smooth finished and dimensioned as in Technical Drawings.

11.2.1.2 *Sub-frame*

Extruded aluminum or galvanized steel sub frame receptors will be furnished with each window unit

11.2.1.3 *Glass and Glazing*

Double clear glass.

11.2.1.4 *Calking and Sealing*

Use elastomeric sealants and chemically curing sealants for interior and exterior applications

11.2.1.5 *Weather-stripping*

Vinyl, moulded or moulded-expanded neoprene or moulded or expanded ethylene, neoprene and polyvinylchloride weather-stripping

11.2.1.6 *Sash Poles*

Seamless aluminium tube, 1.50 mm minimum wall thickness, 25 mm diameter, with cast aluminium hook and protective cover or tip on the lower end. Finish shall match windows.

11.2.2 ALUMINIUM THERMAL BREAK WINDOWS

The windows made up in aluminum alloy profiles are:

- Vertical opening
- Horizontal opening
- No opening

The windows are composed by:

- The aluminium fix frame to be fixed to sub-frame. They are provided with elements for fixing and anchorage to sub-frame structures as well as jutting parts enabling the sliding of sashes.
- The aluminium mobile frame
- The sashes to be screwed to the sub -frame after plastering and painting.
- Water collecting pits
- Accessories
- Galvanized steel reinforcement
- Gasket grooves
- Handles and lock anchor
- Double isolating Glass panels.

Windows technical description:

The windows as described in the Technical Drawings and which dimensions will be taken by the Contractor, are made up in aluminum alloy profiles according to European Standards EN 573 - 3 and duly pre-painted. Colour will be according to the request of investor.

The fix frames will have a depth of 61-90mm. They are provided with elements for fixing and anchorage to wall structures as well as jutting parts enabling the sliding of sashes; profile shape is tubular in order to house assembling accessories. Frame profiles will fit with a cover profile overlapping the wall by 25 mm.

The Mobile frame profiles have a depth of 32 mm and a height of 75 mm with flat or ornamental solution.

Both fix or mobile frames are designed to build thermal break windows and are made up of two aluminum profiles which are joined one another by means of two 15 mm insulating lists made of plastic materials. Thermal break is obtained by inserting 15 mm long and 2 mm thick polyamide strips strengthened with fiber glass.

The profile is designed with a hollow central part for the insertion of the corner joint bracket (with space for 18 mm high glass housing) and the trolleys for their sliding.

Seal is assured by brushes with stiff central fin. The characteristics of seal against atmospherically agents obtainable by these sections must be provable by the certificate of testing affected by the window frame manufactures or by the profiles producer.

The aluminum sections will be painted by a bake lacquering process. The temperature must not exceed 180 degree, the baking time will be less than 15 minutes. The lacquering thickness should be at least 45 mm. The powders used will be made up of high quality acrylic resins or linear polyesters

Opening glassed panels will be hinged to the window frame and will be supplied by a three point anchored lock and handle. Using plastic-elastic materials, after having filled any gap with insulating materials, will carry out the sealing between the cases and the building context.

Between the inside of the steel frame support and the outside of the aluminium fix frame it is preferable to keep an installation tolerance of 6 mm, considering a protrusion of the fixing spacers of about 2 mm. Dimensional tolerance and thickness will be according to EN 755 – 9.

Glass panels (panels of glass 4mm separated by a dehydrated airspace and hermetically sealed 10mm) should be included.

The windows will have a the following Thermal Transmission Coefficient: Thermal Transmission Coefficient value not higher 3 W/m²K.

Fabrication of window units shall comply with following determinations:

Fasteners

Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 2 mm thick.

Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips shall be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

Combination Windows

Windows used in combination shall be the same class and grade and shall be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

Mullions and Transom Bars

Provide mullions between multiple window units which meet the design pressure.

Provide mullions with a structural thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weather tight joint.

Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance. Provide special covers over structural support at mullions as indicated.

11.2.3 GLASS

Insulating clear glass units with two panels of glass 4mm separated by a dehydrated airspace and hermetically sealed 10mm.

The each clear glass will be not less 4 mm

System Insulation: $K = 1,30 \text{ W/m}^2\text{K}$

Air borne Noise Insulation $R'_{wp} 37 \text{ dB}$

Axial Noise insulation $R'_{wp} 46 \text{ dB}$ in horizontal direction, $R'_{wp} 51\text{dB}$ in Vertical direction

The double glass units of the windows, installed below one m from the floor, will have internal glass in safety glass.

11.2.4 ACCESSORIES

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation. Furnish extruded aluminium or galvanized steel sub frame receptors with each window unit.

11.2.4.1 *Hardware*

The item, type, and functional characteristics shall be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

11.2.4.2 *Fasteners and Anchors*

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners shall be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 150 from each end and at midpoint.

11.2.4.3 *Finishes*

Repainted.

11.2.5 SPECIAL OPERATORS

For windows having operating hardware or locking or latching devices located more than 1800 mm above the floor, provide suitably designed operators or locking or latching devices necessary for convenient and proper window operation.

11.2.6 FABRICATION OF STEEL WINDOWS

Form permanent joints by welding or mechanically fastening as specified for each type window. Use joints of strength to maintain structural value of members connected. Weld joints solid, remove excess metal, and dress smooth on exposed and contact surfaces. Closely fit joints formed with mechanical fastenings and make permanently watertight. Assemble frames and sash, including ventilators, at the plant and ship as a unit with hardware unattached. Provide the following construction:

Where fixed window sections adjoin ventilator sections, provide fixed sash, fabricated from similar frame members, and of manufacturer's standard type suitable for the purpose.

Roll weathering surfaces integrally to provide two-point parallel-surface contact with overlap at both inside and outside points of closure.

Provide drips and weep holes as required to return water to outside.

Design glazed windows and rabbets suitable for glass thickness shown on drawings

Use flathead, cross recessed type, exposed head screws and bolts with standard threads on windows, trim and accessories. Screw heads shall finish flush with adjoining surfaces. Self-tapping sheet-metal screws are not acceptable.

For windows with painted finish use cadmium plated or electro-galvanized fasteners. Finish exposed heads to match finish of windows.

11.2.7 PROVISIONS FOR GLAZING

Provide clear glass, thickness not less 4 mm whereby Inside glazing is preferred.

11.2.8 METAL-TO-METAL JOINTS

Set in mastic, using type recommended by window manufacturer to provide weather tight joints. Remove excess mastic before it hardens.

11.2.9 ACCESSORIES

Provide windows with hardware, clips, fins, anchors, glazing beads, and fastenings, necessary for complete installation and operation of ventilators.

11.2.9.1 *Anchors*

Use hot-dip galvanized steel anchors. Secure anchors and fastenings to heads, jambs, and sills of openings, and fasten securely to windows or frames. Use anchors recommended by window manufacturer for specific type of construction and conceal. Anchor each frame at jambs with minimum of three adjustable steel anchors

11.2.9.2 *Hardware*

Equip all operable sash with latching device which can be secured from inside. The item, type, and function of hardware required is specified under individual window type. Attach hardware securely to windows with corrosion resisting bolts or machine screws; do not use sheet metal screws. At fixed screens, adapt hardware to permit operation of ventilators.

11.2.10 WINDOW FINISH

11.2.10.1 *Factory Finish*

Chemically cleaned and bonderized windows. Applied dip coat of epoxy primer baked on for not less than 15 minutes at not less than 149 degrees C followed by finish coat of alkyd-amine enamel of not less than 0.025 mm one mil thickness, baked on for 15 minutes at not less than 149 degrees C.

Finish colour coating to be selected from manufacturer's standard colour chart.

11.3 PART 3 - EXECUTION

11.3.1 INSTALLATION

11.3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. A solid aluminium sub-frame in light galvanized metal tubular will be carefully fixed with steel clamps to the walls by means of cement mortar (no screw sockets). The fixing shall have a distance from the frame corners of no more than 150 mm at a spacing of no more than 800 mm. The fixed window frame will be screwed to the sub-frame when all plastering and painting works are finished. Set windows

at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Install windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place where specified. Opening glassed panels will be hinged to the window frame and will be supplied by a three point anchored lock and handle.

Using plasto-elastic materials, after having filled any gap with insulating materials, will carry out the sealing between the cases and the building context. Between the inside of the steel frame support and the outside of the aluminium fixed frame keep an installation tolerance of 6 mm, considering a protrusion of the fixing spacers of about 2 mm.

11.3.1.2 *Dissimilar Materials*

Where aluminium surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, the aluminium surface shall be protected from dissimilar materials. Surfaces in contact with sealants after installation shall not be coated with any type of protective material.

11.3.1.3 *Anchors and Fastenings*

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls shall have head and jamb members designed to recess into masonry wall not less than 11 mm.

12. PAVING WORKS

CARRIAGEWAYS AND SIDEWALKS

12.1 PART 1 - GENERAL

12.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

12.1.1.1 European Norms and Standards

DIN 18315	Contract procedures for building works - Part C: General technical specifications for building works; Construction works for traffic lines, top layers without binders
DIN 18316	Contract procedures for building works - Part C: General technical specifications for building works; Construction works for traffic lines, top layers with hydraulic binders
DIN 18317	Contract procedures for building works - Part C: General technical specifications for building works; Construction works for traffic lines, top layers of asphalt
DIN 18318	Contract procedures for building works - Part C: General technical specifications for building works; Construction works for traffic lines, stone and tile pavements, kerbs

- DIN EN 1338 Concrete paving blocks - Requirements and test methods.
- DIN EN 1339 Concrete paving flags - Requirements and test methods.
- DIN EN 1340 Concrete kerb units; Requirements and test methods.
- DIN EN 1342 Sets of natural stone for external paving - Requirements and test methods
- DIN EN 1343 Kerbs of natural stone for external paving - Requirements and test methods

12.1.2 GENERAL REQUIREMENTS

The paving shall consist of full depth pavement section or application of hot mineral aggregates uniformly mixed with hot bituminous material over base in compacted mixed grade gravel with cement and sub base in mixed grade gravel. Place the pavement and sidewalk as indicated.

12.1.2.1 Pre-construction Conference

A joint working conference attended by a representative of the Supervisor, the General Contractor, and paving subcontractors shall be held prior to actual paving operation to confirm required drainage slopes, traffic flow and control, paving work sequencing, work start and stoppage, requirements for safety signs and barricades and other construction constraints that need to be considered.

12.1.2.2 *Walk-Thru*

Prior to actual paving operations, a walk-thru of the entire project area by the Supervisor and Contractor shall be conducted to ensure the following:

- All compaction requests have been satisfied;
- No obstructions or stalled vehicles will impede paving operations;
- Required surface preparation has been accomplished and area is ready for execution of sub base, base and bituminous surfacing.

12.1.3 DEFINITION OF TERMS

Subgrade: Existing or borrow earth foundation upon which pavement is constructed

Sub-base: for road Course depth on average is 30.0 cm of mixed grade gravel between the subgrade and the aggregate base course

Aggregate Base Course: depth 30.0 cm. mixed grade gravel course immediately below the bituminous concrete binder course.

Bituminous Concrete Binder Course: depth 5.0 cm

Bituminous concrete layer immediately below the bituminous concrete wearing course.

Bituminous Concrete Wearing Course: depth 3cm

Bituminous concrete layer to finish road pavement as top traffic bearing layer of the pavement.

Sub-base for sidewalk in gravel layer depth 20 cm and cast in situ concrete depth 10cm reinforced with welded steel wire 10x10 cm d. 4mm.

Side walk pavement in precast concrete depth 6 cm on bedding 50 mm thick dry sharp sand.

Wearing course for side walk depth 10cm in concrete for sidewalk

12.1.4 SUBMITTALS

12.1.4.1 *Samples*

Submit samples of materials only as directed by the Supervisor, (b) in lieu of actual samples provide certificates of Compliance for each of the materials listed below with approval by Supervisor:

Granular mixtures

Stabilised granular mixture

Aggregate (2 kilograms for each aggregate size from each source)

Bituminous material four (4) litres

Prefabricated curbs

Materials for curing concrete for sidewalk

Pavement marking paint.

12.1.4.2 *Certificates*

Submit a certificate for each shipment of bituminous materials used in the mix.

Submit a certificate for pavement marking paint.

12.1.4.3 *Test Reports*

Before delivery of materials, certified copies in triplicate of the reports of all tests required herein under materials and in referenced publications shall be submitted to the Supervisor for approval.

Additional testing shall be submitted when the source of materials is changed.

Submit certified test reports for the following:

Granular mixtures

Stabilised granular mixtures

Mineral Aggregates

Bituminous Materials

Concrete

12.1.5 DELIVERY AND STORAGE

12.1.5.1 *Delivery and storage of materials for concrete for sidewalk and base (except ready-mix concrete)*

Packaged materials shall be delivered to the project site in their original, unopened package or container bearing manufacturer's label clearly identifying manufacturer's name, brand name, material, weight or volume, and other pertinent information and stored in their original, unbroken package or container in a weather tight and dry place, until ready for use. Unpackaged aggregates shall be stored in a manner as to avoid excessive segregation or contamination with other materials or other sizes of aggregates. Store reinforcements of different sizes and shapes in separate piles, or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Provide for accurate identification after bundles are broken and tags removed.

12.1.5.2 *Delivery and storage of bituminous mix*

Inspect each truckload of bituminous mix delivered to the site for proper temperature range and reject all loads arriving at the project site that do not meet temperature requirements. No more

than one truckload of mix shall be standing by as load back-up, and temperature of the mix in the back-up truck shall be verified as meeting required limits before use. Any truckload that has been standing for an extended period as to cause the load to cool down below acceptable temperature range shall be rejected.

12.1.5.3 *Paint marking materials*

Paint marking materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, colour, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

12.1.6 TRAFFIC CONTROL:

Vehicular and utility vehicle traffic shall not be permitted on the pavement until the surface temperature has cooled to at least 50 degrees Centigrade and required final rolling and compaction has been achieved. Surface temperature shall be measured by approved surface thermometers. Place barricades and warning signs prominently near the beginning of the work site and around access points to the project area for alerting vehicular and pedestrian traffic of construction operations and/or obstructions.

The use of bunting or multi-coloured, striped cloth materials that can easily be blown by the wind, is not allowed as barricade. Use barricades and warning signs that will withstand the weather and perform their intended function even after hours of darkness.

12.1.7 WEATHER LIMITATIONS

12.1.7.1 *Levelling, Binder and Wearing Courses*

Place the bituminous mixture only during dry weather and on dry surfaces. Place courses only when the surface temperature of the underlying course is greater than 7 degrees Centigrade for course thickness greater than 2.5 centimetres and 12 degrees Centigrade for course thickness of 2.5 centimetres or less.

12.1.8 SAMPLING AND TESTING

The Contractor shall conduct required tests on the sub base and base mixtures also for conformance with specified acceptance quality level

12.1.8.1 *Testing of bituminous mix*

The Contractor shall conduct required tests on the bituminous mix for conformance with the specified asphalt contents temperature and gradation without additional cost to the Supervisor. Mixtures that do not conform shall be rejected. No payments shall be made to the Contractor for pavements or portions of pavements removed for non-conformance and replaced with asphalt pavements, which meet the requirements of this specification.

12.1.8.2 *Testing of concrete for sidewalk*

Surface Test

After curing, test the surface of the pavement with a straightedge (minimum length 3 meters) which will reveal any irregularities in the concrete surface. Remove and replace the concrete, mechanically

grind the concrete surface, or correct the surface as approved, of any portion of the pavement which shows irregularities greater than 3 millimetres in 3 meters, or irregularities in a transverse direction greater than 6 millimetres in 3 meters.

12.2 PART 2 - PRODUCTS

12.2.1 WATER

Shall be soft, potable and free from any suspended inorganic material and chloride sulphate compounds exceeding the percentages indicated. Water shall be slightly alkaline with PH between 6 and 8, shall not include more than 2 parts per 100, by weight, of material in suspension and not more than 15 parts per 100, by weight, of material in solution. It shall not contain organic matter either in suspension or in solution. Sulphate shall not be more than 1 part per 1000 by weight. Sea water is prohibited.

12.2.2 GRANULAR MIXTURE

For the construction of the sub base of the road it will be necessary to use a suitable mixture of granular materials, starting with clay silt 0.074mm and up to gravel and crushed stones with a maximum dimension of 50mm. The grade curve must be contained within the curve limits determined by the Talbot line. The course must have a plasticity index between 6 and 9 (apart from certain situations, according to laboratory surveys which increase the maximum limit which can be raised to 10), provide a guarantee that the upper courses will not desegregate, in a way to realise a clay concrete with a suitable stone skeleton. In the end it must have a liquid limit less than 35 and a CBR. Saturation of 2.5mm penetration not less than 50%. The thickness of the stabilised layer will be determined in relation to the load bearing subgrade and of the loads that must be supported by the traffic (max. Kg 8/sqm) carried out by a CBR (California bearing ratio) punching test on a sample compacted beforehand by the Proctor method.

12.2.3 GRANULAR MIXTURE STABILISED WITH CEMENT

For the construction of the base course of the road it will be necessary to use a suitable mixture of granular materials, starting with clay silt 0.074mm and up to gravel and crushed stones with a maximum dimension of 50mm. The grade curve must be contained within the curve limits determined by the Talbot line. The course must have a plasticity index between 6 and 9 (apart from certain situations, according to laboratory surveys which increase the maximum limit which can be raised to 10) providing a guarantee that the upper courses will not desegregate, in a way to realise a clay concrete with a suitable stone skeleton. In the end it must have a liquid limit less than 35 and a CBR. Saturation of 2.5 mm penetration not less than 50%. The thickness of the stabilised layer will be determined in relation to the traffic loads (max. Kg 8/sqm ascertained by the pneumatic tyres of large trucks) carried out by a CBR (California bearing ratio) punching test on a sample compacted before handling by the Proctor method.

12.2.3.1 *Cement for base course*

The cement used will conform to DIN EN 206. The cement should be delivered in sealed sacks

12.2.4 BITUMINOUS HOT MIX

12.2.4.1 *Aggregate*

For bituminous surface treatment and construction of wearing or binder courses; it will be necessary to use a suitable mixture that shall consist of crushed stone, crushed or uncrushed gravel, screenings, sand, and mineral filler. Grade and proportion aggregate and filler so that the combined mineral aggregate conforms to the grading specified herein. The coarse and fine aggregate and mineral filler shall be so graded and of such character that when combined, a blend will be produced that will meet the requirements specified herein. Stone or gravel to be crushed shall come from eruptive or metamorphic rocks of microcrystalline structure, either siliceous or hard pure calcareous, unbreakable, free of outcrop, with high crushing strength. Products of crushed stone or gravel shall consist of clean, sound, durable particles, shall be uniform in shape, free from adherent films of clay, dust, soft or disintegrated pieces and foreign materials. The particles shall not have more than one rounded face or shall have, at least, two fractured faces and shall be of such nature that a thorough coating of bituminous compound will not strip off under traffic load application. The moisture content shall be such that all particles will be readily coated with the bituminous compound. Drying may be required, as directed.

12.2.4.2 *Bituminous Materials*

TABLE I: PERCENTAGE OF BITUMINOUS MATERIALS (BY WEIGHT)

Bituminous Materials	Levelling Course	Binder Course	Wearing Course
Asphalt	4-5	4-6	6-8
Cutback asphalt	4-5	4-6	6-8
Emulsified asphalt	4-5	4-6	6-8
Asphalt cement	4-9	4-9	5-10

12.2.4.3 ROAD AND SIDEWALK CURBS

The curbs will be in prefabricated vibrated concrete with washed surfaces, the article section will be rectangular with the dimensions 6x20cm.

12.2.5 IN SITU CONCRETE FOR THE SIDEWALK

The sidewalk will be carried out with a concrete of a nominal resistance $R_{ck} 20N/mm^2$, class1 (dry atmosphere with relative humidity less than 70%), maximum dimension of the inert materials equivalent to 30mm, slump equivalent to 3S (semi-fluid), A/C relation less than or equal to 0.65.

12.2.6 CONSTRUCTION EQUIPMENT

Provide equipment dependable and adequate for the purpose intended and properly maintained in satisfactory and safe operating condition at all times. Calibrated equipment such as asphalt distributors, scales, batching equipment, spreaders and similar equipment, shall have been recalibrated by an approved calibration laboratory within 12 months prior to commencing work (and every 12 months thereafter, by such laboratory from the date of recalibration, during the term of the contract).

Motorised grader - they must be self-propelled, supplied with pneumatic tyres with a basic tyre width less than 4m.

Spraying equipment composed of water distribution trucks using a bar to spray uniformly and in variable and controlled quantities.

Soil compactor composed of:

Sheep foot roller: with simple or double cylinder adaptable to compact the indicated materials. Adequately ballasted as requested by Works Director.

Mechanical Tamper: supplied with rubber tyres pulled by a rubber wheeled tractor

Hand Tampers: Minimum weight of 12 kilograms with a tamping face of not more than 300 square centimetres; shall be used in areas not accessible to rolling equipment.

Vibrating roller: with the capacity to develop a variable static load between a min. 300Kg and 1,300Kg

Compressor roller: shall have a minimum weight determined by Works Director. The wheels shall have adjustable scrapers, water tanks and sprinkling apparatus to keep the wheels wet and thus prevent the bituminous mixtures from sticking to the wheels. The rollers shall be capable of reversing without backlash and shall be free from worn parts. The roller's wheels shall not have flat or pitted areas or projections that leave marks in the pavement.

Mechanical Distributor: adjustable and capable of distributing uniformly the quantified materials for every surface sq. m

Mixing equipment: road scarifier, wheel scraper etc.

12.2.6.1 *Spreading Equipment*

Self-propelled electronically controlled type, unless other equipment is authorized by the Supervisor, equipped with hoppers, tamping or vibrating devices, distributing screws, electronically adjustable screeds, and equalizing devices. Capable of spreading hot bituminous mixtures without tearing, shoving or gouging and to produce a finished surface of the required grade and smoothness. Spreader shall be designed with a quick and efficient steering device, a forward and reverse travelling speed, and automatic devices to adjust to grade and confine the edges of the mixture to true lines. The use of a spreader that leaves indented areas or other objectionable irregularities in the fresh laid mix during operations will not be permitted.

12.2.6.2 *Spreading equipment*

Will be used for cement with a regulator of distribution system, with a tolerance of 4% of the quantity required per sq. m.

12.3 PART 3 - EXECUTION

12.3.1 APPLICATION OF SUBBASE COURSE

Granular material taken from a quarry, or crushed or from an alluvial bank ,properly screened, must be spread in long strips on the road surface. To obtain a course thickness as indicated in the drawings successively, carry out the procedure of the mixing in order to obtain a good homogeneity using a moto-grader and by laying at the same time on the road surface.

The layer of material should conform according to the transversal and longitudinal profile of the project.

12.3.2 APPLICATION OF BASE COURSE

For the procedure of application of the base course the work should be carried out as indicated in the previous point (3.1) and further:

The concrete should be cast uniformly in the required quantities and the work should satisfy the Works Director.

Water should be added in the required quantity using pressure spraying bar and uniformly incorporated into the mixture in order to obtain the requested humidity by the Works Director.

After the uniform mixing of the materials with cement the mixture must be compacted in order to reach the density required by the Works Director.

The mixture must be maintained humid with the addition of water in the necessary quantity to cover the water loss during the work procedure, and at the end the layer will be finished in accordance with the regulations provide by the Works Director.

After the course is finished the surface must be immediately covered for a period of 7 days with sand and with lath, in order to prevent further loss of humidity.

The proportion of cement in the mixture will be determined in base of the characteristics of the materials. Normally the percentage will vary from 4 to 14 % in weight on dry weight or from 6 to 16% in volume on the volume of the compacted mixture.

The minimum proportion of the mixture to be used is that indicated in the following:

Give weight loss of the cement materials with respect to the initial weight after 12 cycles of imbibition and drying (carried out according to the test AASHO-T 135/45) and after 12 cycles of frost and defrosting (carried out according to the test AASHO-T 136/45) included, according to the groups in which they belong of the classifications AASHO DM 145-49 in the following limits:

group materials $A_{ria}, A_{ib}, A_{a3}, A_{2-4}, A_{2-5}$ not over 14%

- group materials $A_{2-6}, A_{2-7}, A_4, A_5$ not over 10%
- group materials A_6, A_{7-5}, A_{7-6} not over 7%

give variation of volume during the cycles of imbibition and drying, or of frost and defrosting, not exceeding 2% of the volume of the test pieces;

give the containment of humidity, during the imbibition and drying, or of frost and defrosting, not exceeding the quantity that can completely fill the voids of the test pieces;

give the resistance to the compression in growing proportion with the passing of time and with the increase in proportion of cement in the limits of that proportion which produce the results responding to the requirements indicated in points a),b),c),

12.3.3 EXECUTION OF WEARING COURSE OF SIDEWALK

12.3.3.1 *Ready-mix Concrete Transporting*

Ready mix concrete furnished in revolving concrete mixers on trucks will be acceptable provided the requirements of DIN EN 206, and the following are met:

Placing

Concrete shall be poured monolithically. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than -30 degrees Centigrade. Reduce mixing time to 60 minutes if the air temperature is greater than 30 degrees Centigrade. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. Do not place concrete when: (a) weather conditions prevent proper placement and consolidation; (b) in uncovered areas during

periods of precipitation; and (c) in standing water. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within the forms.

Concrete Pumps

Concrete may be conveyed using concrete pumps only after written approval by the Supervisor. In requesting approval, the Contractor shall submit his entire plan of operation from time of discharge of concrete from the mixer to final placement in the forms. Concrete pumps shall be operated and maintained so that a continuous stream of concrete is delivered into the forms without air pockets, segregation, or change in slump exceeding 5 centimetres.

Concrete Vibration

Immediately after placing, each layer of concrete shall be vibrated using internal concrete vibrators supplemented by hand spading, rodding and tamping. Tamping or other external vibration of forms will not be permitted. Vibrators shall not be used to transport concrete inside forms.

Internal vibrators submerged in concrete shall maintain a minimum frequency of not less than 8000 vibrations per minute. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation, generally from 5 to 15 seconds. Vibrators shall be applied at uniformly spaced points of 45 centimetres.

12.3.3.2 *Cold Weather*

Provide and maintain 10 degrees Centigrade minimum concrete temperature. Do not place concrete when the ambient temperature is below 5 degrees Centigrade. Cover concrete and provide with a source of heat sufficient to maintain 10 degrees Centigrade minimum while curing.

12.3.3.3 *Hot Weather*

Provide and maintain 32 degrees Centigrade maximum concrete temperature. Cool ingredients before mixing, or use other suitable means to control concrete temperature to prevent rapid drying of newly placed concrete. Shade the fresh concrete and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit curing without damage.

12.3.3.4 *Construction Joints*

Shall be on sidewalks and driveways, with width of up to 3.5 meters, provide control joints with spacing not to exceed 3 meters.

12.3.3.5 *Surface Finishes*

Defects

Repair formed surfaces by removing defects. Exposed surfaces shall be uniform in appearance and, finished to a smooth form finish unless otherwise specified.

Floated *Finish*

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleed-water appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. Do not spread dry cement over slab surface to absorb bleed-water. Do not introduce a "topping mix" over the floated finish of a slab to achieve

a smooth finish. Steel trowelling shall be done over a floated finish before fresh concrete sets. Surface shall be level to within 6 millimetres in 3 metres where floor drains are not provided.

Broomed Finish

Provide for exterior walks, platforms and ramps. Provide a floated finish, then finish with a flexible bristle broom. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.

12.3.4 PAVEMENT MARKING

All pavement markings shall be White, 10 cm wide, painted utilising paints designed specifically for pavement markings. Paint shall be applied to dry surfaces only when pavement temperatures are above 4 and below 35 degrees Centigrade during good weather conditions.

Thoroughly clean surfaces to be marked before application of the paint. All pavement marking shall be placed following the manufacturer's application instructions. Minimum curing time of pavement marking shall be 2 hours. Allow a minimum of 30 days of curing time for fresh pavements before application of any pavement markings. When earlier application is necessary because of operational requirements; the minimum curing time may be reduced by approval of the Supervisor.

12.3.5 FIELD QUALITY CONTROL

12.3.5.1 *Tests*

Perform the following minimum number of tests to ensure compliance with the temperature, thickness, and density requirements of all of the courses. Furnish all tools, labour and material for samples and for satisfactory replacement of pavement. Take samples and test at not less than the frequency required for each day's work as a minimum; and at each change in the mix or equipment. Perform the following tests:

Road Sub-base and Road Base In-place Density Test: ASTM D1556 or D2922.

12.3.5.1.1 Thickness Test

Determine thickness of sub base, base, binder and wearing course. Remove samples for the determination of thickness of the completed course in the presence of the Supervisor. One test for each 420 square meters or fraction thereof. The maximum allowable deficiency at any point shall not exceed 6 millimetres of the required thickness. The Contractor shall correct areas found deficient by removing the pavement in question and replacing with new pavement.

12.3.5.1.2 Temperature

Take temperature readings for each truckload of bituminous mix delivered to the site, tabulate and submit daily logs of all deliveries with the "Daily Report to Inspector".

12.3.5.1.3 Smoothness Test

Apply straightedge parallel with and at right angles to the centreline after final rolling... Surface deviations in excess of one centimetre, when tested with a 3-meter straightedge applied parallel with and at right angles to the centreline of the area to be paved, shall be corrected by loosening,

adding and/or removing material, reshaping, and compacting. For sub base and base courses the smoothness requirements specified shall apply only to the top layer.

Test Results of each test shall be forwarded as part of "Daily Report of Inspector". Total number of tons of mix actually incorporated into the project shall also be included as part of the daily report, including number of truckloads, or quantity of mix utilized on the job per work day.

12.3.6 FINISHED GRADE

The finish grades of each course placed shall not vary from the finish elevations, profiles and cross section indicated on the drawings by more than 12 millimetres. The Contractor shall correct deficient paved areas by removing existing work and replacing with new materials meeting the specifications without additional cost to the Contracting Authority. Skin patching for correcting low areas will not be permitted.

12.3.7 PROTECTION

Keep all traffic off surfaces which are freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces. Protect the treated areas from traffic for at least 24 hours after final application of bituminous material and aggregate, or for such time as necessary to prevent picking up. Immediately prior to opening to traffic, roll the entire treated area with a self-propelled pneumatic-tired roller.

12.4 PROJECT APPLIED PAVEMENT & ELEMENTS

12.4.1.1 Concrete tile pavement

12.4.1.1.1 Structure of the road (from top to bottom):

Concrete tiles (prefabricated), t = min. 5cm

Layer bed in sand, t = 3-4cm

Base course of Mineral Mixture (gravel) 0/32, 20cm

Subgrade of compacted aggregate 0/45, 20 cm

12.4.1.1.2 Sub-base and base

Sub-base implies the ground over which the base and the layer of the road will be poured. The base will meet the demands and conditions of the ground works as described in the item. The under-base will be levelled and pressed in a maximal tolerance of +/- 3 cm. The slope (gradient) will be taken into consideration while working with the sub-base.

The base is the supporting layer of the road. After the excavation of the ground to a depth of approximately 30 cm (to the level of sub-base) it will be filled with 0/32 mm up to 0/56 mm gravel material. This material will be placed into well pressed layers. The gradient of at least 1% will be retained even during the laying of the base.

12.4.1.1.3 Concrete Tiles

The contractor must submit different samples of the prefabricated concrete tiles for approval to the Supervisor before the start of the works. The tiles must have certain characteristics, such as:

Resistance > 180MPa

Water absorption < 3%

A highly continuous and homogeneous grain, without apparent flaws on the surface

The contractor shall obtain a certificate from an independent and approved laboratory which proves that the tiles comply with the required provisions. The costs for the sample taking and the laboratory testing are at the expense of the contractor.

After approval of the submitted sample by the supervisor the contractor shall place, at his own costs, a test section of 5 meters long by 5 meters wide that is constructed with the same materials and in the same way as foreseen on the future construction site. The test sections allow the Supervisor to judge homogeneity, colour and general appearance of the surface. If the first test section is not satisfactory, then the contractor will create at his own expense a second test section that takes into account the Supervisors remarks.

12.4.1.1.4 Laying (flooring)

A maximal 5 cm thick sand layer, of a granularity of 2/5 mm to 0/4 mm to be poured on the base over which the concrete tiles are to be placed. A special vibrating machine to be used afterwards to acquire a perfect levelling. Finally the space between the tiles to be filled with 0/1 mm fine sand so as the tiles are best linked with each other and reinforced /stabilise the layer of these stone or concrete tiles.

12.4.1.1.5 The paving comprises:

the placement and fixation of the concrete tiles on a layer of sand according to the details

smoothing out of all unevenness and tyre tracks on the foundation

the filling of the joints according to details.

The concrete tiles need to be fixed firmly by using an appropriate (paving) hammer, in such a way that the underside and the side face are well embedded.

12.4.1.1.6 Controls:

Controls will be executed during the placement of the paving.

Subject to controls: the profile, the flatness and level of the surface bank angle, the difference of level between the edges of the flat surface of the stones, the integrity of the laying pattern, the width of the joints and the quality of the joint filling and the concrete tiles.

The nominal bank angle will be indicated on the plans. If not it is at 2.5 %.

The paving shall not have broken, fissured, flaked stones or stones covered with dirt or mortar.

The laying pattern will be indicated on the detailed plans.

The side faces of the stones in the circular curve pattern should fit together to such a degree that the joints are never wider than 10mm.

The control takes place using topographical measurements.

The control of the total surface is always carried out on a stretch of 3 m. at a time. Irregularities are at the most 5 mm high. The differences in level between adjacent concrete paving stones of the finished surface are max. 2mm. Unless otherwise specified by the Supervisor the side faces of the concrete paving stones should fit together to such a degree that the joints are never wider than 3mm along straight stretches and never wider than 6 mm along curved stretches with a radius

smaller than 15mm. For joint filling with mortar the joint width has to be minimum 8 and maximum 10mm wide.

12.4.1.2 **Sidewalk**

12.4.1.2.1 Sidewalk paving:

Sidewalk paving can be performed in various manners. In spite of the paving manner, the base and sub-base must always meet the necessary technical terms related to the pressing and good material.

12.4.1.2.2 Repair of sidewalks with concrete tiles:

Two types of repairing are to be distinguished while speaking about the repairing of the concrete tiles:

Repair of a rough surface.

Repairing/ changing of one or more tiles

The repair of sidewalks with concrete tiles will be performed in the following manner:

If the damaged tiles need to be changed they shall be removed and be replaced with new tiles of the same product and features. The new tile shall be carefully hit with the end of the hammer in order not to damage it until it reaches the required level and then the gutters are to be filled.

If the surface is not flat the concrete tiles shall be removed to the extent of the damaged area. If a great space of the sub-base is damaged, the base (bedding) under the concrete tiles shall be properly filled and pressed before the tiles are placed as in the above mentioned manner.

12.4.1.2.3 Repairing of the polished cement pavement:

Damaged parts of the polished cement shall be located first. A rectangle is selected over the damaged parts and the surface is cut out to a minimal depth of the existing layer of the polished cement. The selected/cut area shall be carefully removed with mechanical means so as not to damage the sound area, and to be washed with pressure water. Before filling the area other material, it shall be sprayed with liquefied cement to help fix the cement layer with the other layer underneath. A new layer of cement finish shall be laid after that.

12.4.1.2.4 Polished cement flooring:

Excavation of earth on the sidewalks at a minimal depth of 30 cm from the ground surface for a certain planned extension. Installing of 20 cm thick gravel properly pressed and levelled. Installation of 10 cm thick, M150 cement layer, with technical gutters in every 3 m, performed in thin layers and properly vibrated.

Minimal 2 cm thick layer of cement mortar 2:1 to be perfectly polished and levelled, including scaffolding, propping and any other requirements for the satisfactory completion of work.

13. FENCES AND GATES

13.1 **PART 1 - GENERAL**

13.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

13.1.1.1 Applicable Albanian Laws and Norms

13.1.1.2 Applicable European Laws and Norms

13.1.2 SUBMITTALS

Submit the following:

Shop Drawings of fences and gates

Product Data of components

Accessories

Test Reports

Weight in grams for zinc coating

Certificates

Manufacturer's Instructions

13.1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

13.2 PART 2 - PRODUCTS

13.2.1 FENCE AND ACCESSORIES

13.2.1.1 *Vertical Posts*

Vertical posts in zinc-coated steel, min. 50x50 mm, 3 mm gage. Dimensions and height as indicated and detailed in the drawings.

13.2.1.2 *Gates*

Types, single swing, double swing, single wheel sliding Shape and size and material of gate frame, similar to fence as indicated. Gate frames and braces of minimum sizes shall be 50 mm , 3 mm minimum wall thickness Gate leaves more than 2.4 m wide shall have intermediate members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 2.4 m wide shall have truss rods or intermediate braces. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding will not be permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

13.2.1.3 *Fencing Accessories*

Provide wire ties constructed of the same material as the fencing fabric.

13.2.1.4 *Concrete*

Provide as specified in Section "CAST-IN-PLACE CONCRETE STRUCTURES."

13.2.1.5 *Grout*

Provide grout of proportions one part Portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

13.3 PART 3 - EXECUTION

13.3.1 SITE PREPARATION

13.3.1.1 *Clearing and Grading*

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation. Compact fill used to establish fence line.

13.3.1.2 *Excavation*

Excavate to dimensions indicated for concrete-embedded items. Dispose of waste material on site, as directed.

13.3.2 FENCE INSTALLATION

Install fence on prepared surfaces to line and grade indicated. Secure fastening and hinge hardware in place to fence framework by peening or welding.

13.3.2.1 Concrete Slabs and Walls

Provide concrete bases of dimensions indicated. Compact concrete to eliminate voids, and finish as indicated in the drawings. Allow concrete to cure a minimum of 72 hours before performing other work.

13.3.2.2 *Vertical Post Spacing and Setting*

Provide vertical posts spaced equidistantly apart, as indicated in the drawings and not exceeding 170 mm. Set vertical posts plumb. Set vertical posts into zinc-coated sleeves, set in concrete wall, to a minimum depth of 300 mm.

13.3.2.3 *Rails*

13.3.2.4 Install rails if necessary. Pass rail through intermediate vertical post. Provide expansion coupling.

13.3.3 ACCESSORIES INSTALLATION

Vertical Post Caps

Install post caps as recommended by the manufacturer.

13.3.3.1 Gates

Install swing gates to swing through 180degrees from closed to open. Install sliding gates complete with rollers and roller tracks

13.3.4 CLEANUP

Remove waste fencing materials and other debris from the site

14. BATHROOMS AND TOILET FURNITURE AND FIXTURES

14.1 PART 1 - GENERAL

14.1.1.1 Standard

All Toilet Partitions must be scheduled, supplied and installed in accordance with: Local Building Code, CGSB (Canadian Government Specifications Board), CSA (Canadian Standards Association), ANSI (American National Standards Institute), ADA (Americans with Disabilities Act). In all cases the above references shall be taken to mean the latest edition of that particular standard including all revisions.

14.1.2 TOILET WC

WC made of sanitary porcelain, suspended on wall, color/surface white. Flush water Requirement: water saving double discharge, adjustable from 3-4litres. Left-right rear Connections: Complete with internal covering and ½ angle cock. Instantaneous closing

- Float. Complete with all accessories for installation.
- Fastening with screws to installation
- Element, covered, including toilet connection set with sound protection set.

The WC sets are porcelain sanitary toilets made of in Porcelain materials in accordance with international quality standards ISO 9001, as described in the Technical Drawings from designer. The Type of WC set can be Modern (French) suspended type. They will be put in accordance with the Supervisor's requirements.

The WC sets, Modern (French) Type will be strongly fixed on the metallic frame fastened on the wall by brass clamps and screw plugs and screws, without creating gaps in the wall tiling. WC set will be connected with water discharge pipes before the installation on the wall by brass clamps. The outlet of the WC set can be under the body of the set or on the backside of the WC set. The WC set with side outlet should be 19 cm high from floor level.

In the lowest part of the collector basin will be a hole with minimal diameter of $D= 90$ mm. The upper part of WC set can be oval or circular in accordance with the project requirements and WC set type. The height of WC set, Modern type, is 38-40 cm. They will be installed in accordance with the project and Supervisor's requirement. Horizontal Distance between WC Sets and other sanitation equipment (Wash basin, bidet, etc) should be minimum 30 cm.

WC sets should provide a fast and big water flow. They should be resistant against mechanical shutting, corrosion and chemical agents. They should provide water insulation, good condition during the work and easy access for the repair.

The WC set should be connected with sewerage pipes (The connection will be realized with a siphon type tube). The connection pipes of WC sets should be PVC pipes (of the same technical characteristic with other sewerage pipes). Their Diameters should match the outlet of the WC set (Usually their diameter is 100-110 mm).

The WC set will be connected with drinking water system. The connection will be realized to a flash box that can be installed directly on the WC set or on the wall (separately from the WC set). This depends on the type of WC set. The flash box will be installed in the height of 1,5 m high from floor level. The flash box made of porcelain materials will be in accordance the project and quality standards ISO with requirements. The sewerage pipe will be fixed on the wall every 50 cm.

All the supervisor technical requirements to complete the work in a first class should be included. The connection of the WC set with the sewerage pipes should be done by special materials for PP pipes in accordance with the recommendation of the pipe manufacturer. Sample of the WC set together with quality certificate, certificate of origin, test certificate and warranty certificate will be submitted to the supervisor for the initial approval before WC installation at the site. The WC set technical data (including WC type, working pressure, name of the manufacturer, standards and year of production) should be given in the catalogue. The supervisor can conduct on additional test for the mechanical and physical data.

14.2 PART 3 - EXECUTION

14.2.1 EXAMINATION

Site Preparation

The contractor must examine all site conditions that would prevent the proper application and installation of Toilet Partitions. Any defect must be immediately identified and corrected, prior to the installation of the Toilet Partitions.

14.2.2 INSTALLATION

Mounting

All Toilet Partitions must be mounted according Manufacturers' standard locations and those specified on the drawings.

14.2.3 FIELD QUALITY CONTROL

Inspection

After installation has been completed, provide for a site inspection of all Toilet Partitions to determine that all items have been supplied and installed as per the enclosed details. Also, check the operation and adjustment of all Toilet Partitions. Any discrepancies, or malfunctioning product, must be reported to the Supervisor immediately.

14.3 TRASH CAN

Garbage bins will be placed in external systems and will serve food and plastic. The baskets are metal with a diameter of half. 35 cm and average height 70cm and supported on the ground.

