

**DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT OF BINH THUAN PROVINCE  
PMU OF BINH THUAN WATER SECTOR PROJECT**

**CONSULTANCY SERVICES OF TECHNICAL DESIGN AND WORK SUPERVISION**

**SUBPROJECT: HAM THUAN BAC WATER SUPPLY SYSTEM**

**APPENDIX 3  
SPECIFICATIONS PART NETWORK**



**2021  
NIBT ASSOCIATION**





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**2021 - LIÊN DOANH NIBT**



**APPENDIX 3**  
**SPECIFICATIONS PART NETWORK**

***PARTICULAR TECHNICAL SPECIFICATIONS  
HAM THUAN BAC DRINKING WATER SUPPLY NETWORK***

**PART GENERAL**

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## 1 GENERAL

### 1.1 INTRODUCTION

The Particular Technical Specifications of this section shall supplement the general specification requirements and the details as shown on the Drawings. In the case of conflict between details provided on the Drawings and in these Particular Technical Specifications, the instruction provided in the Particular Specification shall prevail. For resolution of conflict between contract documents, the Contractor shall seek clarification from the Engineer.

### 1.2 OVERVIEW OF THE WORKS

Object of this contract, will include the construction of watersupply system for a total extension of 112.320 m (Main pipelines and level 2 pipelines)

No.	Size of water supply pipe	Unit	Quantity	Category
1	Dia.400 pipe PN 10	m	1.006	u.PVC
2	Dia.355 pipe PN 10	m	11.444	u.PVC
3	Dia.280 pipe PN10	m	30.129	u.PVC
4	Dia.225 pipe PN10	m	12.935	u.PVC
5	Dia.160 pipe PN8	m	20.676	u.PVC
6	Dia.110 pipe PN8	m	36.130	u.PVC
	<b>Total</b>	<b>m</b>	<b>112.320</b>	<b>u.PVC</b>

### 1.3. MAIN REFERENCE STANDARDS

- Decision No. 47/1999 / QD-BXD of December 21, 1999 of the Minister of Construction Regarding: Approving the Regulation on water supply and drainage systems in houses and works;
- National technical regulation on drinking water quality QCVN 01: 2009 / BYT, issued together with Circular 04/2009 / TT-BYT dated June 17, 2009 of the Minister of Health;
- National technical regulations on construction planning QCVN 04: 2008 / BXD;
- National technical regulation on safety in construction of QCVN 18: 2014 / BXD;
- National technical regulation on surface water quality QCVN 08-MT: 2015 / BTNMT;
- QCVN 07: 2016 / BXD - National technical regulation on urban technical infrastructure works issued together with Circular No. 01 / TT-BXD February 1, 2016;
- Regulation QCVN 15: 2017 / BXD - National technical regulation on construction works using energy efficiently.
- TCVN 4449-87 Requirements on construction land and master plan.
- TCVN 5576-91: Water supply and drainage system - Technical management regulations;
- Vietnam Standard TCVN 5747 - 1993: Classification of construction land;
- TCVN 2622: 1995 Fire protection for housing and public works.
- TCVN 4453 - 1995: Concrete and reinforced concrete structure in the whole block - Rules of construction and acceptance;
- TCXDVN 33: 2006 - Water supply - external network and construction - design standards;
- TCVN 7570: 2006; TCVN 7572: 2006 aggregates for concrete and mortar;
- TCVN 7305-1: 2008 (ISO 4427-1: 2007); TCVN 7305-2: 2008 (ISO 4427-2: 2007); TCVN 7305-3: 2008 (ISO 4427-3: 2007); TCVN 7305-4: 2008 (ISO 4427-7: 2007),

TCVN 7305-5: 2008 (ISO 4427-5: 2007) on plastic pipe systems - polyethylene (PE) plastic pipes and spare parts for water supply;  
 - TCVN 8491-1: 2011; TCVN 8491-2: 2011; TCVN 8491-3: 2011; TCVN 8491-4: 2011; TCVN 8491-5: 2011- Pipes and fittings connected with (PVC-U) used for water supply and drainage;

<b>PVC pipe</b>	<b>Type</b>	<b>Vietnam standard</b>	<b>Relevant international standards</b>
PVC DN100	Class 3	TCVN 7306-2008	ISO 1452-5
PVC DN150	Class 3	TCVN 7306-2008	ISO 1452-5
PVC DN200	Class 3	TCVN 7306-2008	ISO 1452-5
PVC DN250	Class 4	TCVN 7306-2008	ISO 1452-5
PVC DN300	Class 4	TCVN 7306-2008	ISO 1452-5
PVC DN350	Class 4	TCVN 7306-2008	ISO 1452-5
PVC DN400	Class 4	TCVN 7306-2008	ISO 1452-5

<b>Steel pipe</b>	<b>Type</b>	<b>Vietnam standard</b>	<b>Relevant international standards</b>
DN100	AISI 304, tk 2 mm	TCVN 10357-1:2014	UNI EN 10224
DN150	AISI, tk 2 mm	TCVN 10357-1:2014	UNI EN 10224
DN200	AISI, tk 2 mm	TCVN 10357-1:2014	UNI EN 10224
DN300	AISI, tk 3 mm	TCVN 10357-1:2014	UNI EN 10224
DN350	AISI, tk 3 mm	TCVN 10357-1:2014	UNI EN 10224
DN400	AISI 304, tk 3 mm	TCVN 10357-1:2014	UNI EN 10224
DN500	AISI 304, tk 4 mm	TCVN 10357-1:2014	UNI EN 10224
DN600	AISI 304, tk 4 mm	TCVN 10357-1:2014	UNI EN 10224

<b>Steel pipe</b>	<b>Type</b>	<b>Vietnam standard</b>	<b>Relevant international standards</b>
DN40	PE 100 - PN 6	TCVN 7305-2 : 2008 or ISO 4427-2 : 2007	UNI EN 12201/ ISO 4427-2 : 2007
DN50	PE 100 - PN 6	TCVN 7305-2 : 2008 or ISO 4427-2 : 2007	UNI EN 12201/ ISO 4427-2 : 2007
DN150	PE 100 - PN 6	TCVN 7305-2 : 2008 or ISO 4427-2 : 2007	UNI EN 12201/ ISO 4427-2 : 2007
DN200	PE 100 - PN 6	TCVN 7305-2 : 2008 or ISO 4427-2 : 2007	UNI EN 12201/ ISO 4427-2 : 2007
DN250	PE 100 - PN 6	TCVN 7305-2 : 2008 or ISO 4427-2 : 2007	UNI EN 12201/ ISO 4427-2 : 2007
DN450	PE 100 - PN 6	TCVN 7305-2 : 2008 or ISO 4427-2 : 2007	UNI EN 12201/ ISO 4427-2 : 2007

# **PARTICULAR TECHNICAL SPECIFICATIONS HAM THUAN BAC DRINKING WATER SUPPLY NETWORK PART CIVIL WORKS**

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## **1. General**

The Particular Technical Specifications for Civil and Building Works shall supplement the general specification requirements and the details as shown in the Drawings.

In case of conflict between details provided in the Drawings and details provided in these Technical Specifications, the instruction provided in the Technical Specification shall prevail.

For resolution of conflict between contract documents, the Contractor shall interface with the Engineer in charge for clarification.

## **2. Site Development**

### **2.1 Preparatory Work**

Prior to carrying out any work the Contractor shall inspect the site, in conjunction with the Engineer or his Representative to establish its general condition, which shall be agreed and recorded in writing, and where, in the opinion of the Engineer or his Representative it is deemed necessary, by means of photography or video recording.

Details recorded shall include the location of all boundary and survey beacons the conditions of buildings, surfaces, terracing (if any), ditches, watercourses, roads, tracks, fences, and other information relating to the Site and elsewhere which may be affected by the Contractor's operations.

Prior to the commencement of any part of the works, the Contractor shall make temporary access tracks including all necessary temporary diversions and bridge works to the concerned sites, all to the approval of the Engineer. The Contractor shall maintain such access tracks in a condition suitable for the safe and easy passage of plant and vehicles until they are no longer required for the purpose of the Contract.

All the works shall be executed in conformity with the provisions of the contract documents and with such explanatory detailed Drawings, specifications and instructions as may be furnished from time to time to the Contractor by the Engineer in charge whether mentioned in the contract or not. The Contractor shall be responsible for ensuring that the works throughout are executed in the most substantial, proper and workmanlike manner.

The Contractor shall refer to preliminary information about the geotechnical and groundwater conditions of the site, following the information listed in the Geotechnical Reports. The Contractor shall make his own further investigations as necessary.

### **2.2 Earthwork**

The earthworks shall not be commenced until written approval has been received by the Contractor from the Engineer. The whole of the earthworks for the several parts of the Works shall be carried out to the dimensions and levels shown on the Drawings.

The Contractor shall remove the soil at the top of the original surface over a full depth of 150mm (stripping of topsoil). Stripping shall be carried out in the immediate areas to be occupied by the Works, including areas of excavation where material from excavation may be used in fill, areas to be occupied by Temporary Works, or any other areas as directed by the Engineer. Topsoil reused for covering grass areas within the new plant or other covering shall be excavated and kept aside in approved dumping areas.

The Contractor shall backfill the site in order to allow the construction of permanent works, up to a level in accordance with the specifications shown in the Drawings. All precautions shall be taken while excavations near existing structures are to be carried out till the backfilling is completed.

When excavation requires bracing, sheeting or shoring etc., the Contractor shall submit Drawings to the Engineer, showing arrangements and details of proposed installation.

For deep and huge excavations and in other excavations, if required by the Engineer, the Contractor shall submit for Engineer's approval an "Excavation scheme" showing the methodology to be adopted for excavation in order to maintain the stability of side slopes, means for ensuring safety of existing facilities nearby, dewatering as required etc.

### **2.3 *Unsuitable Materials and Spoil Disposal Area***

If excavated soil is found unsuitable for backfilling, the Contractor shall arrange for a suitable soil from outside. Unless otherwise specified, all materials cleared and grubbed in accordance with this Specification shall become the property of the Contractor and shall be removed from the site and legally disposed of to a designated spoil disposal area.

Placing material in spoil dumps shall be such that it will not contaminate or otherwise render less efficient usable lands or interfere with natural drainage or access. Where required by the Engineer, drains shall be constructed to prevent the undesirable accumulation of water in or around spoil dumps.

The Contractor will remain responsible for the selection of the locations proposed for disposing or storing excavated material, whether temporarily or permanently, and it shall be subject to the approval of the Engineer.

### **3. Watersupply network structures**

#### **3.1 Design standards**

- Decision No. 47/1999 / QD-BXD of December 21, 1999 of the Minister of Construction Regarding: Approving the Regulation on water supply and drainage systems in houses and works;
- National technical regulation on drinking water quality QCVN 01: 2009 / BYT, issued together with Circular 04/2009 / TT-BYT dated June 17, 2009 of the Minister of Health;
- National technical regulations on construction planning QCVN 04: 2008 / BXD;
- National technical regulation on safety in construction of QCVN 18: 2014 / BXD;
- National technical regulation on surface water quality QCVN 08-MT: 2015 / BTNMT;
- QCVN 07: 2016 / BXD - National technical regulation on urban technical infrastructure works issued together with Circular No. 01 / TT-BXD February 1, 2016;
- Regulation QCVN 15: 2017 / BXD - National technical regulation on construction works using energy efficiently.
- TCVN 4449-87 Requirements on construction land and master plan.
- TCVN 5576-91: Water supply and drainage system - Technical management regulations;
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- TCXDVN 33: 2006 - Water supply - external network and construction - design standards;
- TCVN 7570: 2006; TCVN 7572: 2006 aggregates for concrete and mortar;
- TCVN 7305-1: 2008 (ISO 4427-1: 2007); TCVN 7305-2: 2008 (ISO 4427-2: 2007); TCVN 7305-3: 2008 (ISO 4427-3: 2007); TCVN 7305-4: 2008 (ISO 4427-7: 2007), TCVN 7305-5: 2008 (ISO 4427-5: 2007) on plastic pipe systems - polyethylene (PE) plastic pipes and spare parts for water supply;
- TCVN 8491-1: 2011; TCVN 8491-2: 2011; TCVN 8491-3: 2011; TCVN 8491-4: 2011; TCVN 8491-5: 2011- Pipes and fittings connected with (PVC-U) used for water supply and drainage;

#### **3.2 Pipeline Construction**

##### **3.2.1 Pipe laying**

ll pipes are to be supported on the required depth of pipe support material as shown on the Drawings to prevent any possibility of the pipes being displaced during or after jointing.

Pipes are to be laid true to line and grade. Each spigot is to enter the full depth of the socket of the adjacent pipe and is to be truly concentric therewith, so as to make the interior of the joint smooth and continuous and with no lip at the invert.

Deviations in pipelaying from the indicated line, level and grade of pipeline shall not exceed 50mm, or as otherwise required on the Drawings. In wet ground, pipe shall nowhere be laid or jointed until the water has been removed from the trenches and maintained at a satisfactory low level by means of adequate and approved pumping appliances.

Drainage of surface or ground water into the laid pipeline will not be permitted, and, to prevent this, an approved plug is to be maintained in the ends of the laid pipeline.

### *3.2.2 Construction methods for National Highway*

Hydraulic jack system shall be used to lay pipes across the National Highway 1. Foundation pits will be excavated to install and receive the pipe jacking equipment.

Larsen piles and horizontal struts will be used for support of the pit walls to retain soil for jacking foundation pits as detailed in the design drawings.

### *3.2.3 Construction methods via railway:*

Hydraulic jack system shall be used to lay pipes across the railway. Foundation pits will be excavated to install and receive the pipe jacking equipment.

Larsen piles and horizontal struts will be used for support of the pit walls to retain soil for jacking foundation pits as detailed in the design drawings.

## **3.3 Testing**

Concrete blocks and bricks shall be of standard size, hard, sound, square and clean. They shall be of Sulphate resisting cement type HS, conform to TCVN 6067:2004.

The Contractor shall submit samples of blocks/bricks to the Engineer for approval and arrange strength tests required by the Engineer to be executed by a testing authority proposed by the Contractor and approved by the Engineer.

Prior to the system the start-up, the Contractor shall test the pumping stations under the Water-Tightness test: the contractor shall be responsible for carrying out the complete test, rectifying the leakages if any. The cost of providing equipment, labor for carrying out tests shall be borne by the Contractor. The test shall be performed within 2 days of notice, and however before backfilling.

In case of leakages, the Contractor shall provide to repair them after pre-approval of the Engineer.

***PARTICULAR TECHNICAL SPECIFICATIONS***  
***HAM THUAN BAC DRINKING WATER SUPPLY NETWORK***  
***PART MECHANICAL WORK***

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## 1. Technical Specifications of water supply network

### 1.1 General description

The water pipeline is designed to for clean water supply of 13/17 villages and townlets in Ham Thuan Bac District.

The water supply pipeline is calculated as followed: weak point (the farthest and highest point of the water supply pipeline) in the biggest water tank, water-to-air ratio  $K_h = 1.62$ . Use Epanet hydraulic calculation software for calculation and selection of pipe diameter.

Type of water supply pipe: pipe and accessories uPVC DN400-DN100 PN10.

Pipes through the ditch, over the bridge, through the rail using pipe HDPE DN400 – DN100.

Rail tubes are used on the secondary pipe to ensure the safety of the tube when the vessel is operating above. The depth of buried pipe is ensured in TCXDVN 33: 2006 of Vietnam.

The sections of pipes crossing bridges and ditches use concrete support pillars and use HDPE pipes.

Block valves, air discharge valves, exhaust valves. The air release valve with protective corrugated box ensures the safety, the protective valve block is protected by the Upvc construction pipe above with cast iron cap.

The connection points, bridge crossing points, ditches, blocking holes, discharge holes are shown in the detailed drawings.

No.	Size of water supply pipe	Unit	Quantity	Category
1	Dia.400 pipe PN 10	m	1.006	u.PVC
2	Dia.355 pipe PN 10	m	11.444	u.PVC
3	Dia.280 pipe PN10	m	30.129	u.PVC
4	Dia.225 pipe PN10	m	12.935	u.PVC
5	Dia.160 pipe PN8	m	20.676	u.PVC
6	Dia.110 pipe PN8	m	36.130	u.PVC
	<b>Total</b>	<b>m</b>	<b>112.320</b>	<b>u.PVC</b>

### 1.2 General characteristics for acceptance

Pipe and fittings shall be made of unplasticized polyvinyl chloridematerial, with the following requirements:



- Standard: ISO1542-5
- External diameter: D110-D315mm
- Apparent pressure 10 bar
- Pipe length 5m -8m

uPVC to ISO 1542-5

Manufacture :according to ISO 1542-5

Thickness: to ISO 3126-74

## **2. Requirements on technical organization of construction and supervision:**

- When constructing, the contractor must follow the design. If there is any problem, the contractor must immediately inform the PMU and the Technical Supervision Consulting Unit for timely resolution. The Contractor must strictly abide by the above technical standards.

- The contractor must have a plan on construction and arrangement of construction tools at the construction site so as not to affect the surrounding activities; to work out plans on exploiting electricity and water sources for serving the construction. The contractor must pay costs related to electricity, water and auxiliary items (camps, warehouses, temporary offices, telephone, fax, ect.) during the construction

- Basing on the construction and acceptance criteria and the technical design dossiers, the contractor himself shall have to compile dossiers on a process and plans to inspect the quality, clearly stating:

+ The quantity and mass of samples to be used for testing or checking for each type of construction materials, building components and construction products (clearly stated), the name and legal entity of the implementation unit in inspection and the use criteria.

+ The testing or checking schedule (the time of commencement and completion of the dossiers, handing over tested or checked results to the investor) must be in accordance with the construction schedule and in accordance with the regulations on standards used in testing and checking.

+ The records of tested or checked results must be sent to the investor (state the list, specific contents and the minimum quantity of 4 sets /once in inspection) before announcing the requirement for acceptance of any components, parts, stages.

## **3. Requirements on types, quality of materials, machinery and equipment (attached to the standards of testing methods):**

### **3.1 Some main material and equipment:**

+ UPVC pipes and fittings: The first class plastic quality produced by a **known** brand factory (or equivalent and must be approved by the PMU before

the construction), it must ensure the thickness and standards of design, have a certificate of quality inspection at the factory, particularly for fresh water supply pipelines, the required pressure of the pipelines according to design documents must be met. Do not use plastic pipes and fittings with the second class quality or drain pipes to install water supply pipes.

+ Galvanized iron pipes: The thickness of the pipe, the thickness of the zinc layer and the weights have met the used standards for water supply and as directed by the design consultants. Tested pressure of pipes has to meet design requirements. Do not use conventional steel pipes and processed galvanized steel pipes.

+ Types of valves: Use flange cast iron valves, stainless steel wheel bolt, screw valves manufactured by advanced countries. Note that the quotation must specify the country of manufacture and its supplies, no supplier's name required.

- Other types of materials such as constructional bricks, ceramic tiles, fixtures and equipment of toilet, electrical wires, sockets, switches and accompanied accessories. In case of using domestically produced goods, the origin, manufacturer's name and technical standards must be clearly stated,...

- Materials to be used for producing construction components must have factory certificates (except sand and stone) and quality test certificates (issued by the legal entity) and confirmed the approval of the PMU, supervision consultants, design consultants.

- All types of materials, equipment used for construction works must be 100% new goods (packages must be intact, unopened) which are inspected the quality. Before being put into use, the contractor must submit finished certificate at the factory of the supplier (original), in case of using a copy, the material supplier must sign and affix the seal, at the same time, it is approved by the PMU. The Contractor and the material supplier must be responsible under the law for the quality of goods they supply to the works.

- Materials, equipment such as cement, steel, HDPE pipes, PVC pipes, galvanized iron pipes, doors, sanitary equipment and fittings ... They are products that have been notified of the acceptance and announced standard conformity published on the website of the competent authorities and properly preserved, put in the camp, not to put outdoor.

### **3.2. Work of site preparation:**

#### **3.2.1. Pipes and accessories that are made of steel:**

- Steel pipes must meet ASTM A53, or BS 1387, or KSD 3057 / SPP, or JIS G 3452 / SGP or other equivalent standards.

- The pipes are manufactured by ERW resistance welding, the two ends of the pipes must be straight and beveled.

- The chemical elements of the pipe material must be guaranteed.

• Chemical Elements of Carbon (C)  $\leq$  0.25%

- Chemical Elements of Phosphorus (P)  $\leq$  0.04%
- Chemical elements of Manganese (Mn)  $\leq$  0.95%
- Chemical elements of Sulfur (S)  $\leq$  0.05%

- Standard length per pipe: 6.0 meters.

- Each pipe must have the following parameters: Manufacturer's name or label; Pipe symbol; Size: stipulation diameter (inside) x thickness; Number of pipes; months and years of production.

- Inner and outer protection layer: Pipes must be covered with a layer of zinc powder or a layer of paint containing zinc powder along with a layer of Epoxy by spraying lead, or rolling over inside and outside pipes by reel to protect them. The standard thickness of the protective coating of steel pipe must be gained 300 microns. The surface of the coating after drying should be even, smooth and glossy to avoid increasing hydraulic losses in the pipe when transporting water.

### **3.2.2. PVC pipes:**

\* Technical characteristics of plastic pipe:

- The main raw material for the production of pipes is PVC powder and additives that are necessary for the manufacture of pipes.

- Blue PVC pipes that are homogeneous.

- Useful length:  $L = 6 + 0.05$  m, excluding bowl mouth section. To be convenient in transportation, it is acceptable to  $L = 5.5 + 0.05$  m but the whole lot of goods must be homogeneous.

- The smooth head of the pipe shall be chamfered ( $15 \div 20$  mm) with a bevelled angle of  $15^\circ$  and the marker shall be shown to know the length of putting the pipe.

- Body of pipe should show the following:

+ Manufacturer's name and logo - pipe size (outer diameter and pipe thickness) - pressure level - material - standard of production. In addition, the contract number and the contracting entity's name may be further shown to the pipe body (if necessary).

+ The spacing of each line of words as mentioned above is from 500 mm to 600 mm. The size of the letters on the pipe body according to the manufacturer's standard for each type of pipe.

\* General characteristics of gasket:

- Applicable standard: AS 1646 - 1992 or equivalent.

- Hardness of gasket: (45 - 55) shores

- On the surface of the gasket is molded by embossed letters or printed year of manufacture, the size and the name (or logo) of the manufacturer (may be abbreviated).

- Word size: 3 mm high, 2 mm wide. If being molded, the thickness of 0.5 mm is stipulated for embossed letters and the content of the letters must be displayed at the position where does not affect the joints.

### **3.2.3. Gate valve:**

Resilient Seated Flange Gate Valve

Origin: Europe or equivalence

Maximum working pressure: 16 bar

Operation by crank

Manufacture standard: DIN 3352

Standard size:

- Flange standard: EN 1092-2.

- Distance between two flanges: DIN 3202 – F4

- Quality certificate: ISO 9001:2008

Standard of paint Epoxy: Epoxy Blue Ral 5017 certified by organizations: WBS-WRc (England) in according to standard of BS 6920, DVGW-KTW (German) and NF-KTW (France).

- The valve body must show the following contents: logo (or name) of the manufacturer, valve size, manufacture standards, pressure levels, year and month of production (if any).

Resilient seated flange gate valve, flat bottom, with a valve cover.

The valve is closed clockwise.

Valve body and valve cover:

- Body, cover, wedge: Sphere cast iron GGG-50 (EN-GJS-500-7) according to DIN-EN1563, equivalent to BS 2789 Grade 500-7.

- Valve axis: made of stainless steel AISI-420 (equivalent to 420S29 according to BS 970 part 1, X20Cr13-DIN 17440), threaded, polished by cold rolling method.

- Wedge sheath, layer of lining: EPDM

- Painted by Epoxy (inside and outside; including lining paint) with the minimum thickness of the paint layer is 80µm.

Valve plate:

- Soft cast iron according to EN1563, marked as GGG-50
- Covered with EPDM rubber or be equivalent.

Test valve according to ISO 5208.

Tight gaskets of bolt of valve made of neoprene rubber or equivalent.

Bolts connecting valve body and valve cover must be made of stainless steel, SUS 304.

Material of cap used to cover valve bolts is the same kind with valve body material and the size of cap head is 30 x 30 mm (tolerance of  $\pm 2$ mm) and is fixed firmly to the end of valve bolt (spindle) by bolts (or screws) of stainless steel, SUS 304.

#### **3.2.4. Check valve**

Swing check valve has automatic function to prevent reverse flow.

Origin: Europe or equivalence

Maximum working pressure: 16 bar

ISO 9001:2008

Valve is manufactured according to standard EN 12334.

Flange and bore sizes are standard ANSI B16.1 CLASS 125

- Valve body, valve plate and valve axis are made of stainless steel of ANSI 316.

- Gaskets that are between valve body and valve cap are made of EPDM rubber.

Coating: Epoxy Blue Ral 5019 certified by organizations: WBS-WRc (England) in according to standard of BS 6920, DVGW-KTW (German) and NF-KTW (France).

Valve plate is a type of self-resilient with a stainless steel core of ANSI 316 that is tight covered by EPDM rubber. Hinges and valve plate are assembled together by a bolt made of standard stainless steel.

#### **3.2.5. Air vent valve:**

Single-type air vent valve has a wide hole and operate in either automatic or semi-automatic mode with flow current to the flange according to standard ISO.70005 – 2 (EN 1092 – 2 : 1997, DIN 2501).

The valve is suitable for use for clean water or raw water and it has to work well under minimum pressure of 0.2 bar at 10 bar and its temperature may gain at 90°C

All valves must be tested for hydraulics with pressure level of 1.5 as compared with a nominal pressure.

Valve body and valve cover must be made according to Standard DIN 1691 and coated with a blue epoxy coating.

### **3.2.6. Electric control valve:**

- Electric actuators for valves must be designed to perform well the valve functions. Specifically, it performs flow control function or open-close function according to IEC 34 / VDE 0530, type S4-25% ED or S2-15 minutes.

- The actuator must be designed so that it is easy to install, test, make experiment, maintain and repair

- The actuator must have a grade of protection, including electric motors, meet Standard EN 60 - 259, grade of IP67.

- Electric motors should meet the technical requirements such as:

+ Electric motors must be of three phase type – 380V, 50Hz.

+ Ensuring good operation with ambient temperature from minus 25°C to positive 60°C.

+ Electric motor must be completely sealed type, not ventilated. Electric motor compartment and electric motor cover are made of aluminum that can withstand sea water environment.

+ The insulation of the electric motor must meet IEC 85 class F (155°C).

- The bearings of the actuator must be self-lubricating without any maintenance in overhaul times. Gears made of annealed steel, screw axis made of bronze and tin.

- Under all operating conditions, the noise level of the actuator shall not exceed 75 dB (A) at a distance of 1 m.

- All actuators must have full records of the parameters of electric motors as well as stainless steel actuators are mounted on two different points of the actuator.

- The wear protection of the actuator must meet the requirements of the test by saline spray in accordance with DIN 50021.

- Power switch of the actuator shall be a type of plugged-in electrical connector for quick assembly when there are repair or maintenance requirements or to carry out experiments by testing equipment.

### **3.2.7. Coupling**

- Be suitable for all kinds of pipes such as: Soft cast iron pipe, steel pipe, HDPE pipe, PVC Pipe and produced with nominal pressure PN 10.

- Two ends and its body must be made of soft steel according to Standard BS EN 10025: 1990, grade PE 430A.

- Couplings must be coated Epoxy both inside and outside by electrostatic paint coating method according to Standard WIS 4-52-01.

- Couplings having gaskets must be made of EPDM rubber according to Standard BS 2494: 1990, Class W.

- Bolts having dome head and oval neck are galvanized for anti-rust purposes, grade 8.8.

Hexagonal screw nuts must be galvanized for anti-rust purposes. Washers must also be galvanized for anti-rust purposes

### **3.2.8. Stepped Coupling**

- A type of coupling used to connect pipes of different outer diameters.

- Be suitable for all kinds of pipes such as: Gray cast iron pipe, soft cast iron pipe, steel pipe, HDPE pipe, PVC pipe and produced with nominal pressure PN 10.

- Two ends and its body must be made of soft steel according to Standard BS EN 10025: 1990, grade PE 430A.

- Couplings must be coated Epoxy both inside and outside by electrostatic paint coating method according to Standard WIS 4-52-01.

- Couplings having gaskets must be made of EPDM rubber according to Standard BS 2494: 1990, Class W.

- Bolts made of galvanized and rust-proof steel, grade 4.6.

- Hexagonal screw nuts must be galvanized for anti-rust purposes, grade 4. Washers must also be galvanized for anti-rust purposes

### **3.2.9. Flanged adaptor**

- A type of soft joint with a flange end.

- Be suitable for all kinds of pipes such as: Gray cast iron pipe, soft cast iron pipe, steel pipe, HDPE pipe, PVC pipe and produced with nominal pressure PN 10.

- Ends and its body (including a flange) must be made of soft steel according to Standard BS EN 1092 -2 PN10. Other types of flange drilling can also be carried out according to individual requirements.

- Flanged adaptors must be coated Epoxy both inside and outside by electrostatic paint coating method according to Standard WIS 4-52-01.

- Flanged adaptors having gaskets must be made of EPDM rubber according to Standard BS 2494: 1990, Class W.
- Bolts made of galvanized and rust-proof steel, grade 8.8.
- Hexagonal screw nuts must be galvanized for anti-rust purposes, grade 4. Washers must also be galvanized for anti-rust purposes.

#### **3.2.10. Bolts, nuts, washers:**

- Bolts are manufactured in accordance with BS 4190 or equivalent.
- Washers are manufactured in accordance with BS 4320 or equivalent.
- Bolts, nuts, washers with undergoing a high force which are manufactured in accordance with BS 4395 or equivalent.
- Stainless steel bolts, nuts, washers which are made of stainless steel 316S31 in accordance with Standard BS970, or equivalent.

### **4. Requirements on the order of construction and installation:**

#### **4.1. Site preparation:**

##### **4.2.1. Implementation:**

When the contract and the contract performance guarantee have been signed, the PMU shall be requested to handover the site for executing the works. The contractor must carry out the transportation and gathering of materials, building camps, collecting and disseminating plans, construction measures, tempo, safety quality and environmental protection.

As for preparation of construction site: The contractor must carry out field survey, determinate construction boundaries and scope of works to implement the clearance work, opening routes, leveling high hillocks, filling holes to create plane to build camps and storages. The contractor shall have to arrange drainage system on the routes, establish a system of execution roads from outside to the site and internal roads inside the site to become a complete site system in order to facilitate the execution work, supplying guidance and supervision on the site later.

##### **4.1.2. Work of location determination of works, setting out landmarks:**

After completion of site preparation work, the contractor shall have to carry out the work of locating the works, setting out landmarks to determine the scope of foundation pits, necessary size to dig and fill, placements for pouring soil and rock, taking full advantage of waste rock and soil, the system of drainage canals and diversion canals to pump for drainage; these tasks are done by technical design units, the PMU, construction supervision unit. Parameters to be determined: Design elevation, landmark elevation, natural elevation of routes of the works and items, these parameters must be shown in the outlined drawings in the construction diary for storing.

#### **4.2. Excavation work:**



#### **4.2.1. The work of digging pipes and foundation pits:**

- **Handmade:** Applicable to small works, narrow construction scope, no ground to operate an excavator. Construction tools:

+ For land in grade 2, 3: using mandrels, crowbars.

+ For land in grade 1: using ledles, hoes, shovels

Way of digging:

+ Using mandrels and crowbars to dig and break land in grade 2, 3 with every layers of 0.2 m thick to avoid falling back to the dug ditch and vacant land where the construction and installation of pipes and to avoid people moving.

- **Mechanical excavation:** - Mechanical excavation: applicable to dug area with large scale, ensuring sufficient space to implement.

Equipment: Excavator.

##### **- Way of digging ditches:**

+ Ditches must be dug to the depth specified by the design, If a ditch is dug deeper than the design permission, it must be filled with fine soil or sand to the specified depth, watering and compacting carefully to avoid sagging to deflect the pipe.

+ The bottom of the ditch must be made clean, flat. At the locations of jointed pipes, joints, must be dug deeper than the ditch bottom with 0.1m deep so that the entire body of the tube is contiguous to ground of the ditch bottom.

+ For ditches with rugged rocks must be dug deeper and be filled with sand to become flat.

+ The width of ditches must be dug to the width specified in the design.

+ Note: In the case of ditches are under groundwater or are submerged by rain wáter, must take measures to prevent landslide and use pumps to make dried dug ditches. If the soil at the ditch bottom is mortar by submerging, the mortar soil must be carried away and leveled by clean soil and then compacted before installing the pipes. In the case of weak foundation that can cause a landslide, the contractor must have measures to shield the ditch wall carefully during the construction period.

##### **- Supporting for ditches to be dug:**

To ensure labor safety throughout the construction process, ditches to be dug must have been propped up by scaffolds to avoid the landslide, the scaffolds to prop up the ditches to be dug should reach the following criteria:

+ Quick assembly

+ Ensure bearing capacity

+ Easy disassembly after finishing works.

+ Ensure the required space in the construction area to assemble pipes

#### **4.2.2. Work of filling up soil of pipe routes and foundation pits**

- After installing pipe routes completely, dug ditches must be filled up by dug soil, only using fine soil with no gravel or stone, filling up in each layer of 0.2 m, watering with enough moisture and using a jumping jack compactor to compact that soil layer carefully.

The work of digging ditches and pipe installation must be carried out synchronously and must be returned the primitive status of the ground in the same day so as not to affect the traffic safety, lives and activities of the household.

### **4.3. Work of installing pipes:**

#### **4.3.1. Requirements for equipment, piping and accessories:**

- All equipment, piping and accessories must be inspected at the manufacturing plant in accordance with the requirements of the state standards, must ensure the ability to work normally and be easy to repair and replace in the future.

- Before taking the equipment, pipes and accessories into the works, they must be checked and be acceptance test for ensuring proper size, thickness and without cracks, holes and other defects.

- Equipment, galvanized iron pipes and fittings, especially the welds must be painted once by anticorrosive paint, then painted twice for enshrouding.

#### **4.3.2. Installing pipes:**

The material and equipment in the required technical instructions should be complied with the model, trademark, type, specifications, ect., according to the approved design documents.

##### **a. General requirements:**

The contractor must provide labor, materials, tools, equipment and means for loading, unloading and arranging and installing pipes according to proper pipe routes, slope and elevation shown in the technical design documents approved.

##### **b. Pipes should be kept clean:**

- Before installation, the pipes should be clean, free from dirt to be existed in the pipes. After installation, the pipes are always kept clean, so that there is no trouble with washing and disinfecting the pipes afterwards.

- When pipe installation is not finished but the work is stopped, all pipe ends must be sealed for preventing animals or people from getting into the pipes, maintaining pumping to drain dirty sewage and avoiding dirty water flowing into the pipes.

##### **c. Checking pipes before installing**

- Prior to installation of supplies and accessories must be certified by the Employer to ensure quality in the work diary.

##### **d. Soil fixture:**

Soil fixture must be continuously homogeneous in load bearing strength for the length of the pipe except for the small grooves between the pipes used to dismantle the pipe strap ... These pipes shall be filled up and compacted as required.

#### **4.3.3. Joints and accessories:**

##### **a. General requirements:**

The contractor must provide labor, materials, tools, equipment and means for loading, unloading and arranging and installing accessories shown properly in the technical design documents approved.

##### **b. Installing joints:**

###### **\* As for bell-mouthed smooth joints:**

Angle deviation of the joint should not exceed the limit set by the manufacturer or manufacturer's instructions

###### **\* Soft joints:**

- Bolts should be tightened slowly so that the joint parts fit into their positions evenly.

- The joints must be made in accordance with the manufacturer's instructions.

- Soft joints shall be tested and classified by the way of testing pressure and cutting force.

###### **\* Flange joints:**

- Must be assembled in accordance with the manufacturer's instructions, as well as the maximum twisting torque limit allowed to effect on each bolt.

- Flange joints will be assembled as follows:

+ Align the parts that are connected to each other in a straight line

+ Arrange them so that the bolt holes fit together, leaving a gap to put a jointing ring

+ Put a jointing ring in the middle of the flange and assemble the bolt

+ Assemble the bolt and tighten slowly according to the pipe circumference, opposite one another pair by pair.

###### **\* Sag of joints:**

- When the joint has the clearance required for adjustment of pipe direction or slope, this adjustment is only made after completion of the connecting work mentioned above.

- Sag of joints should not exceed the design specifications or the pipe manufacturer's guidelines.

###### **\* Completion of joints:**

During construction and installation of piping, the Contractor must strictly comply with the instructions and requirements for executing joints of the manufacturer. The joints of the pipes and between the pipes and spare parts must ensure tightness, avoid leaks, openings to reduce the pressure of the pipe when commissioning. If the joint is not closed, the Contractor must repair and remedy, and must be approved by the Supervision Consultant.

- When the jointing ring is installed in the correct position, then will complete the joint by plastering a mortar around the outside of the joint.

Displace the joint to create horizontal or vertical curvature of  $\leq 10\text{mm}$ .

If the clearance exceeds 10mm to achieve the required deviation, a multi-pipe bending method or setting spare parts must be considered.

- The washers placed the mouths of the joints should be maintained in cool places, away from direct sunlight until they are used;

c. Supporting bearings and platforms:

- Elbows, tees, wads must be supported by the edges of parent soil, on the platforms or driving piles to keep fixed as required in the documents of the technical design - execution.

- The size of the supporting bearings and the platforms: The construction contractor must ensure the size and cross section as required.

d. Recessed pipe sections in walls:

- The pipe sections to be placed in the concrete wall must be completely processed as designed, be cleaned, painted to protect in accordance with regulations.

- Before pouring the concrete, the components must be placed in the correct position, and ensure that the components are not moved during pouring the concrete.

- The components recessed in the concrete should be kept stable from the time of pouring the concrete to the concrete ensuring a proper strength. During that time, do not collide to avoid cracks between the components and the concrete.

#### **4.3.4. Pressure test of pipeline:**

##### **a. General:**

- Pipe sections installed completely must be tested pressure in accordance with the approved design documentation and current regulations to ensure that the pipelines and fittings are certainly subjected to a fixed test pressure without moving any pipes and components and water leakage not to be over an acceptable level.

- When a pipe section to be executed gets 500 m long, the pressure must be tested before proceeding to the next section.

- The Contractor must provide the personnel and equipment necessary for this test.

- The pressure of the test pipe section is specified by the design and measured at the lowest point of the test pipe section (in the case of uneven ground conditions)

- Before conducting the test, the Contractor shall notify the Supervision Consultant, the Employer and the relevant agencies for being approved and implemented.

- The Employer, Supervision Consultants and relevant agencies must be present at the testing time to confirm the results.

- The contractor must self-supply and shall bear the cost for water sources to test the pipelines.

- Water sources for testing must be approved by the supervision consultant. The costs of water treatment (if necessary) must be paid by the Contractor.

**b. Sealing pipe ends:**

- The forces generated by the pressure test require that the end caps should be carefully laid so that the impact force does not affect to cause breaking the ground, existing structures or special structures.

- The Contractor is proposed to provide a detailed design of end caps or a device for sealing pipe ends in accordance with the force generated during the pressure test, together with detailed designs of the supporting parts and shall be approved by the Supervision Consultants before carrying out the production.

- The pipeline must be filled up enough soil to ensure that the pipeline is protected against pressure impact, especially at the positions that are near the elbows or near the platforms must be firmly ensured. The contractor must pay the costs of repairing damaged joints.

**c. Pressure test:**

**Preparation:**

- Installing Blind flanges at all of the branches of the bleeder valves, exhausting, placing a cushion, an abutment, fixing the pipe firmly, filling up soil on the back of the pipe and the abutment before testing.

- Setting the gas discharge valve on the blind flange located at the end of the pipe section tested and the gas discharge valves, by-pass tees for discharging gas, ensuring that the full priming is carried out before testing pressure.

- Using clean water to test. After filling up the water and ensuring that there is not any gas left in the pipe, and then closing the gas discharge valves for carrying out the pumping to increase the pressure in the pipe.

**Carrying out the pressure test:**

- Water should be supplied into each pipe section at a gradual rate, taking care not to condense gas. Pipes must be filled with water until hydrostatic pressure test is done.

- The test pressure is 1.5 times of the working pressure of the pipe specified in the design dossier. During the time of the whole pipeline trial, it will be monitored by the Employer, Supervision Consultants and other relevant agencies.

- If a leakage is detected while inspecting the pipe and joints, the Contractor must pay himself any cost for repairing and remedying until the approval of the Supervision Consultants and the Employer is obtained.

**d. Leakage rate to be allowed:**

- The amount of leaked water measured during the pressure test ( $\geq 2$  hours) at the stable pressure level, must not exceed the total allowable amount of water  $V$  (is the amount of water to be injected in order to maintain the prescribed pressure),  $V$  shall be determined according to the following formula:

$$V = \frac{L \times D \times \sqrt{P}}{715.317} \quad (\text{litter/hour})$$

In which:

L: is the length of the test pipe section

D: is the nominal diameter of the pipe

P: is average test pressure 600 Kpa (1 at = 100 Kpa)

- The pressure test results must be recorded in writing, if obtained the requirements, to be filled soil and carry out the next section.

#### **4.3.5. Rinse, discharge and disinfection of pipelines:**

\* Rinse, discharge of pipelines:

During installation, the contractor will use the necessary measures to keep the inside of the pipe clean and free from water, stone, dust, rubbish and other obstacles falling into the pipe. After completing the installation, the contractor should proceed to flush out water for letting the remaining stains in the pipe out and maintain it until acceptance.

Performing the work of washing pipelines by using foam rubber

\* Disinfection of pipelines:

The contractor must provide workers, equipment and facilities for disinfection of the entire pipeline route and necessary costs for effective disinfection.

After the pipeline has been tested pressure, it should be cleaned and disinfected as follows:

+ All pipeline routes must be rinsed with clean water until no trace of dirty substances or different color comparing with the washing water.

+ The disinfectant solution is prepared by mixing in water for 5 minutes in a clean tank which is not eroded by chlorine (Sodium hypochlorite solution containing 15% chlorine) being mixed into clean water with the rate of 0.8 liters / 1000 liters of water, The solution must be mixed every day.

+ The disinfected pipe section should be soaked for at least 24 hours, then the contractor takes water sampler through the discharge valve under the monitoring of Supervision Consultants; the measure of residual chlorine in the water samples and its treatment are performed as follows:

If the sample contains only residual chlorine  $\leq 2$  mg / liter, disinfection will be carried out again.

If the test water sample is approved, the pipeline will be rinsed and filled with clean water and keep it for at least 1 hour.

Two samples of water taken later will be done at the same time, as the previous sample, one sample is used to determine excess chlorine, the other is contained in a sterile bottle for microbiological testing, depending on those

analysis results which the contractor should have ways for processing as follows:

- + If excess chlorine  $\geq 4$  mg / liter, it should be discharged and disinfected again.

- + If the results of the microorganism-tests are not satisfactory, it should be disinfected again, taken samples to analyze until the requirements are met.

Note: Disinfectant pipelines are absolutely not connected to other water supply pipelines.

#### **4.4. Work on concrete - reinforced concrete:**

- 4x6 stone concrete is used to line the foundation must be mixed with 4x6 stone and after that to be brought it to the poured position. Do not spread stone before pouring mortar. The concrete layer must be compacted carefully, the stone interstices should be sealed by mortar, no pore stone.

- Formwork and scaffolding structure must ensure stability, stiffness and durability, proper size and shape in accordance with the design drawings, tightness and flat for dismantling without damaging the formwork and not affecting the concrete, safety for people who come in or come out, facilitating the transportation of materials and equipment for execution.

- The design details related to the concrete will be casted: must be studied in advance to perform during executing the formwork and not affect the concrete, not make difficult to put reinforcing bars during pouring and compacting the concrete.

- Formwork after machining, erection must be checked before acceptance based on the following norms:

- + Accuracy of formwork as compared with the design

- + Accuracy of the components is available.

- + The tightness between the formworks.

- + The solidity of formwork and supporting frames of the scaffold.

- The concrete pouring process must regularly check the shape and position of the formwork. It must be timely handled or immediately stopped pouring the concrete when there is a deformation.

- The dismantling of the formwork and the load on the structural parts is only carried out after the concrete has reached the required strength corresponding to the following indications:

- + Remove the lateral formwork parts that are not capacity of bearing weight of the hardened concrete: It is only allowed to be dismantled after the concrete reaches a sufficient strength to ensure that the surfaces, corners and edges are free of chipping or slide.

- + Remove the formworks with bearing capacity of reinforced concrete structure: It is only allowed to be dismantled after the concrete reaches a sufficient strength as specified for each type of structural elements.

+ To load entirely on the structures that are dismantled the formwork: It is only allowed after the concrete reaches a designed strength

- Steels to be put in reinforced concrete structures must be processed and installed according to the design dossiers. Prior to using the reinforcement, they must be tested to ensure their strength according to the requirements as designed.

- The surface of steel bars must have been clean, no mud, no oil, no iron scale, no rust. Steel bars are not crushed and reduced in cross section.

- Steel bars must be straightened. Bended or arched positions must be in accordance with the designed dossier. Before connecting steel bars, the Contractor should be made a plan for arrangement of the connecting positions with the agreement of a technical staff of party A and the designer. Steel bar link must be in accordance with the requirements of the design dossier that is allowed to be fastened or welded. The links must meet technical requirements.

- Materials used in the production of concrete include cement, sand, stone must meet the requirements of current technical standards. Sand must be tested before being used, with special attention not to use saline sand.

- In order to improve the features of concrete, additives are allowed to be mixed into concrete mortar. The additives used must have the technical specifications to meet the current standards, the use must conform to the instructions of the manufacturer. Concrete components used additives must be agreed with Party A and have the written permission of the Department of Construction before being used.

- Concrete mortar must be mixed and compacted by machine to ensure the technical requirements. Tasks such as transport and maintenance of concrete also have to comply with the technical requirements.

- Concrete compaction by needle vibrators must comply with the following requirements:

+ Do not let a needle vibrator touch the reinforcement during compaction.

+ Do not compact too long in concrete mortar.

+ Do not use a needle vibrator to level concrete mortar.

+ Put a needle vibrator quickly and in a vertical position, then pull out gradually

+ Put a needle vibrator into a new position, not more than 50 cm away from the former position.

- All reinforced concrete in the works must be inspected the quality to meet the design requirements.



It is recommended that ready mixed concrete should be poured for the items such as treatment tanks, filtration tanks, clean water tanks, flat roof of a house to ensure quality.

### **5. Requirements for pilot operation, safety:**

After the construction and completion of all items in the works in accordance with the technical requirements presented in this chapter and in the construction drawings, the contractor must finish the works, dismantle temporary works, move residual materials, equipment and machinery of the contractor, process wastes, clean the area of construction site and make the environment of constructed area is the same as before it was not constructed. After completing all the works mentioned above, the contractor shall be considered for accepting the whole works by the supervision officer.

### **6. Requirements on fire and explosion prevention and fighting:**

The works are prone to occur fire and explosion, so the contractor must have measures to ensure the safety of electricity and fire and explosion prevention.

### **7. Requirements on environmental sanitation:**

- Construction contractors must take measures to ensure environmental protection for laborers on the construction site and protect the surrounding environment, including measures against dust, noise, waste treatment and collection, making tidy up the construction site. For construction works in urban areas, it must be taken measures for using tarpaulins to cover and for disposing of wastes brought to the prescribed places.

- In the process of transporting construction materials and wastes, it must be taken measures for covering in order to ensure safety and environmental sanitation.

- The construction contractor and the investor shall have to inspect and supervise the construction environment protection and at the same time they must be accepted the inspection and supervision by the State management agency in charge of environment. In cases where construction contractors fail to comply with the regulations on environmental protection, the Employer and State management agencies in charge of environment may suspend the construction and request the contractors to strictly comply with the regulations on environmental protection.

- Persons who commit acts of damaging the environment during the construction must bear responsibility under law and pay compensations for damage caused by their faults.

### **8. Requirements on labor safety:**

- All workers on the construction site must be disseminated on the regulations of labor safety. The site management committee is responsible for

reminding and inspecting workers to comply with the rules on occupational safety. On the construction site, there must be signs of occupational safety, especially at the location easily cause accidents.

- All construction machines must be used by professional workers, people who do not have any tasks not to operate the machines arbitrarily or repair them.

- The use and arrangement of workers on the construction site must be consistent with the health of each person. People who drank wine, beer and using other stimulants are prohibited to be on the scaffolds.

- Electrical lines should be neatly arranged, without causing obstructions or obstacles and ensuring safety for people and motorcycles on the construction site. The use of equipment such as safety belts, safety net ... to ensure the safety of workers at the placement or the work that need to be used.

- In addition, construction contractors must comply with the current regulations (specifically, in accordance with Circular 22/2010 / TT-BXD dated 03/12/2010 on occupational safety in construction works).

- Transportation of construction materials and equipment mainly used by road with transport vehicles or can use roads which are being constructed for transportation. As for vehicles are used to transport construction materials (especially sand) that often come in and come out the interior of a city must have tarpaulins to cover materials to avoid dropping, causing pollution and affecting the traffic safety.

- Because the construction route is located in the residential area, there will be some technical works such as electricity poles, telephone, etc. and other underground constructions. In the process of arrangement to construct, it is necessary to pay attention to all measures to ensure a safe in the exploitation of the infrastructures. It must be regularly monitored during the construction, if any problems arise with the infrastructures, it should immediately notify the supervision consultant, the PMU and design consultants to timely handle.

- Before being put into service and during the construction process, all motor vehicles must be inspected regularly horns, brakes to ensure that they are always in good working condition.

- When constructing at night, it must ensure adequate lighting and signs, barriers in the necessary areas.

- It is forbidden to operate the machine without the operator.

- When the construction is stopped (more than 6 hours), the machines used for the construction must be cleaned, arranged in a straight line so that they do not cause any obstacles in the traffic. Motor vehicles must be braked and chocked wheels carefully, and to assign various people to guard them.

- To ensure traffic safety, there is a chart of coming in and coming out must be specified for the trucks used for transporting materials.

- At the construction site:

+ It is obligatory to have fences and walls to separate the construction area with residential areas along the two sides of the construction route to prevent dust, reduce noise and completely separate the traffic between the two areas.

+ Prior to the construction, "construction-site" signs must be located, signs of restricting speed of vehicle at the beginning and the end of the road which is being constructed. There should be instruction boards and assign a person to guide for types of means of transport on the road, specify process of coming in and coming out according to the chart for the trucks used for transporting materials and equipment ...

+ Workers must have boots, gloves, masks, and protective clothing.

+ Prior to each shift, all machinery and equipment for construction must be inspected.

+ Must have medical equipment to serve first aid, especially first aid when burns.

+ When the construction is completed, it must be tidied up, do not let asphalt, rocks fill the sewers, drop on the road, do not let asphalt stick to the sewers and trees along the road.