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Marafeq Qatar



LUSAIL DEVELOPMENT

District Cooling Distribution System Design Guidelines for Supply of Pre-Insulated Pipes for Mega-development

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| 0 | IFI | 12-04-2012 | | A | Muhammad Ali | Abdullah Abushaikha | D. Reed Phillips |
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| PFC | Preliminary for Comment | A | Approved |
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1 INTRODUCTION

1.1 General

This document and the attached files define the technical requirements to furnish pipe and materials for the portion of the district cooling system referred to as Mega-Development. For ease in understanding, these documents are prepared as if the project was broken into three separate contracts, but in fact they are all components of a single contract between the Client and one contracting party.

In the end, the contracting party is responsible for all aspects of the project and that all tools, equipment, and devices are suitable and reliable for the intended use and in the ambient conditions expected at the construction site. He shall be responsible for all documents and procedures requested by authorities for the official inspection and acceptance of the works.

In general the technical tender documents are described as:

- LUS-CPALL-MAQ-SPE-UT-00001 Pre-insulated Pipes: The scope of supply is described as pipe and materials including delivery to a lay down area designated by Client, but the scope does NOT include fabrication or installation of pipe (mechanical works) or trenches (civil works).
- LUS-CPALL-MAQ-SPE-UT-00002 Civil Works: The scope of supply is the civil portion of the underground piping system and thus does NOT include pipe materials or mechanical installation.
- LUS-CPALL-MAQ-SPE-UT-00003 Mechanical Works: The scope of supply includes mechanical installation of pipe and materials, but does not include furnishing materials or preparing the trenches.

1.2 Tender documents package

This document is part of the total tender package and ultimately will be incorporated into the project Agreement.

1.2.1 Technical Requirements Supply of Pre-insulated Pipes – documents package

This document specifies technical requirements for supply of pre-insulated district cooling pipes and fittings and is a part of the total Technical requirements for Supply of Pre-insulated pipes package.

The Scope of Supply is defined by:

- This document.
- Appendices and drawings in accordance with Drawings/Documents List form (DLF).

1.3 Scope of Supply

The Supplier shall provide material and services necessary for a complete, safe and prudent underground pipe system as described herein.

Delivery shall be made in accordance with good industry practice, notwithstanding certain essential items not being expressly stated in these requirements or elsewhere in the Request for Proposal (RFP).

The Scope of Supply shall include, but not be limited to the supply and delivery of:

1. Pre-insulated carbon steel pipes intended for installing underground.
2. Pipe elbows, branches, and other fittings, valves and auxiliaries.
3. Surveillance system(s).
4. Outer jacket casing pipe joints.
5. Documentation.

Laying down pipes in the trench, installation and welding of the steel pipes will be carried out by the Mechanical Contractor and is **not** a part of this Scope of Supply.

2 DEFINITIONS, ABBREVIATIONS AND REFERENCES

2.1 Definitions

The following expressions shall, where the context so permits, have the meaning hereby respectively assigned to them.

| | |
|----------------------|--|
| Client | The master developer - Lusail Real Estate Development Company (LREDC) or its appointed representative. |
| Contractor | The organization or its appointed representative, responsible for execution of the works. |
| Customer | The owner / sub-developer in-charge of the building. |
| Engineer | Marafeq's supervision engineer or its appointed representative. |
| Marafeq | The utility company which provides District Cooling, Gas Supply and Waste Management services. |
| Mega-Developer | The owner of the district. |
| Sub-Developer | The owner of the building. |
| Vendor | Any invited companies being fully eligible to submit the Tender. The successful Vendor will be the contractor/Supplier. |
| Works | Means work, products, materials, computer software and documentation, and other work as called for in the Agreement. |
| Agreement | Means the contract or other written agreement entered into between the Client and a contracting party regarding supply of the Works including appendices, amendments, and additions agreed in writing. |
| For Information only | Means information only is indicative and not under responsibility of the Client. Vendor has to control, verify and be responsible for any such information in the same manner as other submittals. |
| Must | This is a minimum requirement. |

| | |
|----------------------|--|
| Must | This is a minimum requirement. |
| Shall | Indicates a mandatory requirement. |
| Should | Indicates a preferred method or material. |
| Request for Proposal | Means the document prepared and issued by the client who includes this document and other general and particular requirements. |

2.2 Abbreviations

| | |
|-----|---------------------------------|
| DP | Design pressure |
| ID | Internal diameter |
| OD | Outer diameter |
| WT | Wall thickness |
| QCP | Quality Control Plan |
| FAT | Factory Acceptance Test |
| SAT | Site Acceptance Test |
| RFP | Request For Proposal |
| WPS | Welding Procedure Specification |

2.3 Reference documents

2.3.1 Codes, standards and specifications

Material supplied by the Supplier and work, methods, testing, and actions carried out by the Supplier shall, at a minimum, conform to the requirements of the codes listed below.

When an edition date is not indicated for a code or standard, the latest edition in force at the time of contract award shall apply.

| | |
|----------------|--|
| EN253 | Pre-insulated bonded pipe systems for directly buried hot water networks. |
| EN448 | Pre-insulated fittings for bonded pipe systems |
| EN488 | Pre-insulated valves for bonded pipe systems |
| EN489 | Joints and connections for pre-insulated bonded pipe systems |
| EN13941 | Design and installation for bonded pre-insulated pipe systems. |
| EN14419 | Surveillance systems for bonded pre-insulated pipe systems |
| EN10216-2 | Seamless steel tubes |
| EN10217- 2, -5 | Welded steel tubes |
| EN10253-2 | Butt welded steel fittings |
| EN13480 | Metallic industrial piping |
| P235GH | Steel quality |
| EN 12517 | Non-destructive testing of welds. Radiographic testing of welded joints |
| EN12613 | Plastic warning devices for underground cables and pipelines with visual characteristics |

| | |
|-----------------|--|
| EN ISO 5817 | Fusion welded joints in steel and alloys. Quality levels for imperfections. |
| EN206-1 | Concrete: Specification, performance, production and conformity. |
| EN287-1 | Qualification test of welders. Fusion welding – Part 1: steels. |
| E 287-3 | Welding procedures tests. |
| EN288-2 | Specification and approval of welding procedures for metallic materials. Welding procedures specification for arc welding of steels. |
| EN288-3 | Specification and approval of welding procedures for metallic materials. Welding procedures specification for arc welding. |
| EN ISO 9692-1 | Welding and allied procedures – Recommendations for joint preparation. |
| EN ISO 11970 | Specification and approval of welding procedures for production welding of steel castings. |
| ISO 12096 | Submerged arc-welding steel tubes for pressure purposes – Radiographic testing of the weld seam for the detection of imperfections. |
| EN ISO 15607 | Specification and qualification of welding procedure for metallic materials. General rules. |
| EN ISO 3834 | Quality requirements for fusion welding of metallic materials. |
| EN ISO 15614-1 | Specification and qualification of welding procedures for metallic materials -- Welding procedure test -- Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys. |
| EN 10253-1,-2 | Butt welding pipe fittings. |
| QCS | Qatar Construction Specifications. |
| Kahramaa | Water and Electricity Components. |
| QCD | Qatar Civil Defense. |
| Other standards | Mentioned or referred to in the complete package of Tender documents. |

2.4 Document precedence

The Contractor shall notify the Engineer of any conflict between this specification, the related requirements and/or data sheets, the codes and standards and any other specifications noted herein. Resolution and/or interpretation precedence shall be obtained from the Engineer in writing before proceeding with the design or manufacture.

In case of conflict, the order of precedence shall be:

1. Material narrative specifications.
2. Project specifications and standards.
3. Industry and official codes and standards.

3 TECHNICAL REQUIREMENTS AND SPECIFICATIONS

3.1 General

The piping system shall be supplied as pre-insulated bonded carbon steel pipes with polyurethane foam insulation (PUR) and with high density polyethylene (HDPE) outer casing jacket.

Works, pipes, and components shall meet the technical and environmental requirements of the applicable directives and standards.

Health and safety requirements and the function of safety related systems must be fulfilled.

3.2 Basic design conditions

| | |
|-----------------------------|--|
| Design pressure | 1600 kPa |
| Operating temperature range | 4.0 – 16°C |
| Soil temperature range | 10 – 50°C |
| Ambient design temperature | 50°C; maximum outdoor temperature during installation |
| Water quality | See table in paragraph 3.3. |
| Calculated life-time | Pipes, works, and components shall be designed for a calculated life-time of 40 years. |

3.3 Distributed water quality

The Client intends to maintain the circulated water quality as noted in the table below.

| Parameter | Data |
|------------------|-------------------|
| pH-value | 8.0 +/-1.0 |
| TH (°F) | 2 - 20 |
| Punctual TH (°F) | 8 - 20 |
| TAC (°F) | 35 +/- 10 |
| Total copper | 0.2 +/- 0.1 mg/l |
| Total iron | 2.0 +/- 0.5 mg/l |
| Conductivity | 471 +/- 251 µs/cm |
| Chlorides | 10 +/- 2 mg/l |
| CO ₂ | > 30 mg/l |
| O ₂ | 1.0 +/- 0.1 mg/l |

4 PRE-INSULATED PIPES

4.1 General

Pre-insulated bonded pipe systems for directly buried water networks. Pipes assembled by carbon steel service pipe, polyurethane thermal insulation and outer casing of high density polyethylene (HDPE).

The pre-insulated bonded piping shall comply with standard EN253 as minimum. Certification of testing from independent party to verify compliance with EN253 shall be provided.

Pipe ends shall be delivered free from insulation for welding in the field. Insulation of the free pipe joints and joining of the outer casing pipe shall be carried out with a proven reliable method, as further described.

A surveillance system based on copper wires moulded into the pipes and components foam insulation shall be included in the pre-insulated piping system as described in greater detail in clause 4.2

4.1.1 Chilled water service carbon steel pipes

The service carbon steel pipe shall conform to dimensions in accordance with DIN 2458 and steel quality P235GH in accordance with standard EN10216-2, EN10217-2 and 10217-5.

Elbows, reducers, tees and other fittings shall comply with standard EN10253-2 type B.

Pipes shall be delivered from factory in 12 m or 16 m length sections.

Seamless steel tubes in accordance with EN10216-2 shall be used for dimensions up to DN350.

Welded steel tubes in accordance with EN10217-2 (ERW) or EN10217-5 (SAW) shall be used from dimension DN400 and larger.

Carbon steel pipe dimensions:

| Dimension | Outer Diameter | Nominal Wall Thickness |
|-----------|----------------|------------------------|
| DN100 | 114,3 mm | 3,6 mm |
| DN125 | 139,7 mm | 3,6 mm |
| DN150 | 168,3 mm | 4,0 mm |
| DN200 | 219,1 mm | 4,5 mm |
| DN250 | 273,0 mm | 5,0 mm |
| DN300 | 323,9 mm | 5,6 mm |
| DN400 | 406,4 mm | 6,3 mm |
| DN450 | 457,0 mm | 6,3 mm |
| DN500 | 508,0 mm | 6,3 mm |
| DN600 | 610,0 mm | 7,1 mm |
| DN700 | 711,0 mm | 8,0 mm |
| DN800 | 813,0 mm | 8,8 mm |
| DN900 | 914,0 mm | 10,0 mm |
| DN1000 | 1016,0 mm | 11,0 mm |
| DN1100 | 1120,0 mm | 11,0 mm |
| DN1200 | 1220,0 mm | 12,5 mm |
| DN1300 | 1320,0 mm | 12,5 mm |

4.1.2 Thermal insulation

The pre-insulated pipes and fittings shall be delivered with high density polyurethane foam applied at factory. The polyurethane foam shall be bonded to the carrier pipe and the outer casing jacket pipe. Minimum insulation requirements:

| Property | Min. requirement |
|---|-------------------------------------|
| Closed cell content | > 90,0 % |
| Size of cells | < 0,3 mm |
| Core density | ≥ 60 kg/m ³ Note1 |
| Thermal conductivity at 50°C (λ ₅₀) | < 0,029 W/mK |
| Water absorption | < 5 % (volume) |
| Compression strength | > 0,30 MPa |
| Axial shear strength, 23 deg C new | > 0,12 MPa |
| Axial shear strength, 23 deg C aged | > 0,12 MPa |

Note 1: Core density is currently not defined in EN253:2009. However, the specified density is required for handling large diameter pipes. (It was included in the previous EN253:2003. Requirements are considered by CEN/TC 107, to be included again in next EN253 standard version.)

Thickness of insulation varies depending on pipe size. See dimensions of outer casing jacket pipe in paragraph 4.1.3.

Before insulation is applied, the external surfaces of the carrier pipe and the inner surface of the casing pipe shall be cleaned and treated to maximize adhesion between the insulating foam and the adjoining surfaces.

4.1.3 Outer casing jacket pipe

The outer casing jacket pipe functions as the vapour barrier (barrier against condensation) and shall be manufactured in UV-stabilized HDPE in accordance with EN253 or equal.

| | |
|---------------------|--|
| Materials | High density polyethylene (HDPE) bimodal minimum PE80, ISO 12162 |
| Density | Min. 944 kg/m ³ |
| Pipe wall thickness | According to EN253 or equal |

Outer casing jacket pipe dimensions:

| Dimension | Outer Diameter Casing Pipe | Minimum Casing Wall Thickness (mm) |
|-----------|----------------------------|------------------------------------|
| DN100 | 200 mm | 3,2 |
| DN125 | 225 mm | 3,4 |
| DN150 | 250 mm | 3,9 |
| DN200 | 315 mm | 4,5 |
| DN250 | 400 mm | 4,8 |
| DN300 | 450 mm | 5,2 |
| DN350 | 500 mm | 5,6 |
| DN400 | 520 mm | 5,7 |
| DN450 | 560 mm | 6,6 |
| DN500 | 630 mm | 7,2 |
| DN600 | 780 mm | 7,9 |
| DN700 | 900 mm | 8,7 |

| Dimension | Outer Diameter Casing Pipe | Minimum Casing Wall Thickness (mm) |
|-----------|----------------------------|------------------------------------|
| DN800 | 1000 mm | 9,4 |
| DN900 | 1100 mm | 10,2 |
| DN1000 | 1200 mm | 11,0 |
| DN1100 | 1300 mm | 11,8 |
| DN1200 | 1400 mm | 12,5 |
| DN1300 | 1500 mm | 15,9 |

4.2 Surveillance system

For detection and location of moisture in the insulation, a complete surveillance system including main central computer, surveillance units, outside cabinets, cable connectors, etc shall be included in the works.

Detailed design of the leak detection system for this specific project shall be carried out by the Supplier and included in the delivery. Detailed design shall include, but not be limited to, size and location of control loops, location of alarm units, commissioning and documentation.

The surveillance system shall be specially designed for District Cooling systems. This especially means, among other requirements, that the detection wires must be designed in order to avoid problems caused by "natural condensation" in the foam insulation and moisture from condensed ambient air.

The foam insulation naturally has a low non-detectable concentration of moisture equally spread between steel pipe and outer casing jacket. In operation, the warmer atmosphere outside the insulated pipe will create a process in which the natural moisture travels towards the colder steel pipe and eventually will reach a high concentration. The detection wires must be able to handle the consequences of such natural "moisture travel" without giving any false alarms.

The detection wires shall be insulated copper wires mounted as 3 parallel wires at a fixed distance between the conductors in a common cable conduit. The common cable conduit shall be assembled directly to the media steel pipe.

The system shall detect moisture in the foam by measuring impedance along the insulated copper wires. By detecting faults early, damage and degradation of the insulation and/or corrosion of the service pipe can be minimized. The system shall also be able to locate a break of the surveillance copper wires.

The system shall, beside copper wire and constant distance elements, include a sufficient number of microprocessor based monitoring alarm units.

The surveillance units shall operate on a pulse reflection method and be able to survey the entire system including straight pipes, bends, branches and other fittings. The system shall also be capable of detecting more than one leak after acknowledgement of previous or current leak.

Only pulse surveillance units (for use in district cooling systems) shall be supplied. Resistance surveillance (commonly used for district heating systems) will not be accepted.

The surveillance system shall work as a fully documented system taking measurements of each increment of the entire sensor wires and storing the received data in a non-volatile data base memory as start-up data. In monitoring mode, actual data and start-up data shall be compared in order to detect deviations.

System sensitivity shall be selectable in different levels in such a way that minor irregularities from the installation phase can be detected and accepted as “zero-figures”.

Surveillance units shall be prepared for communication with a central system for supervision of all alarm units in the system. Communication shall be possible via GPS, signal or optic cables and 24/7 surveillance from a centralized control room shall be possible.

In the tender, the Vendor shall completely describe the system he is proposing. Only well-proven systems for district cooling applications with documented reliability from experienced suppliers will be accepted.

4.3 Outer casing pipe joints

Supply and installation of joint kits for the outer casing HDPE pipe shall be delivered to the amount specified in Bill of Quantity.

Delivery shall comply with the requirements in EN489 as minimum.

Not all joint kits will be installed at completely straight pipe joints so it is important that joint kits are designed to accommodate small angles of deviation.

The Vendor shall in his tender specify all relevant data including:

1. Maximum allowed deviation-angle for a “standard” joint kit.
2. Special joint kits for deviation-angles larger than the standard joint kit.
3. Required education of fitters for each type of delivered joints.

4.3.1 Joint kit's with heat shrinkable casing

A joint kit includes a tubular heat-shrinkable casing, sealant mastic's, additional outside sealing sleeves and polyurethane foam for applying on site.

Joint kit's with heat shrinkable casing shall only be supplied for dimensions DN 150 and smaller.

Tubular heat-shrinkable casing

The casing portion in a joint kit shall consist of an oversized tubular casing for application on the pipe end prior to welding. The casing shall be manufactured of cross linked, high density polyethylene layers.

The tubular casing shall be manufactured heat-shrinkable with a gas torch. Sealing plugs for the insulation holes shall be included in the works.

Length of the casing shall minimum overlap 100 mm of adjacent pipe component's casing.

Sealant mastic and sleeves

Delivery of wide sealant mastics strips for installation on the pipe ends under the tubular casing shall be included in the works.

Additional outside heat-shrinkable sealing sleeves for application after installation of the tubular casing shall be included for double security.

Polyurethane foam insulation

Polyurethane foam shall be delivered in sets/kits for mixing and applying on site.

Sets/kits shall be delivered with sufficient volume to seal each pipe size and based on a calculated average application temperature.

4.3.2 Joint kit's with electro welded casing

A joint kit includes a tubular casing, strips for electro welding, welding sleeves with accessories and polyurethane foam for applying on site.

Joint kits with electro welding casing shall be used in dimensions DN 200 and larger.

4.3.3 Special joints for on-site made branches

For branches made on site in accordance with paragraph 4.5.2, special joints shall be provided in the quantities listed in the Bill of Quantity.

Delivery shall comply with the requirements in EN489 as minimum.

Vendor shall present the design and specifications in his tender.

4.4 Straight pipe lengths

Straight pipes shall be delivered in standard 12 m and 16 m lengths, in the quantities listed in Bill of Quantity.

Each pipe end shall be free of foam installation at a minimum length of 250 mm. Pipe ends shall be bevelled as specified in standard EN ISO9692-1.

All pipes shall be delivered with plastic end caps in order to avoid debris in the pipes, during transportation, storing and handling.

Delivery shall comply with the requirements in EN253 as a minimum.

4.5 Pipe elbows

Pre-insulated elbows shall be delivered in accordance with clause 4.5.1; in general for directional changes greater than 10 deg.

Steel pipe elbows (uninsulated fittings) shall be delivered in accordance with clause 4.5.2; in general for directional changes from 0 to 10 deg.

4.5.1 Pre-insulated elbows

Pre-insulated elbows shall be delivered to the quantities listed in Bill of Quantity. Delivery shall comply with the requirements in EN448 as minimum.

Each pipe end shall be free of foam installation at a minimum length of 250 mm. Pipe ends shall be bevelled as specified in standard EN ISO9692-1.

All pipe components shall be delivered with plastic end caps in order to avoid debris in the pipes, during transportation, storing, and handling.

4.5.2 Steel pipe elbows

Uninsulated steel pipe elbows are used for sizes larger than DN350 in small angles between 0 to 10 degrees and shall be delivered in the quantities listed in Bill of Quantity.

An uninsulated steel pipe elbow is welded in between two straight cut pipe ends to create an angle of deviation. The elbow shall be designed in such a way that the inner arc length exceeds 40 mm for DN400 - DN500. For larger dimensions shall the inner arc length exceed 50 mm.

Field joints are insulated and sealed on site using standard or special joint kits (as defined in paragraph 4.3.2, 4.3.3).

4.5.3 Mitred pipe ends

For directional changes from 0 to 10 deg for piping DN 350 and smaller, the Mechanical Contractor will miter the pipe ends in the field.

4.6 Branches and T-pieces

Branches and T-pieces shall be delivered to the amount specified in Bill of Quantity.

Delivery shall comply with the requirements in EN448 as minimum. Pipe used for branches shall comply with the requirements stated in clause 4.1.1.

Branches shall be supplied as pre-insulated branches or site made branches in accordance with the table below:

| Main pipe | Pre-insulated branch | Site made branch |
|------------------|----------------------|-------------------|
| DN500 | DN250 and larger | DN200 and smaller |
| DN600 and larger | DN350 and larger | DN300 and smaller |

4.6.1 Pre-insulated branches

Each pipe end shall be free of foam insulation for a minimum length of 250 mm. Pipe ends shall be bevelled as specified in standard EN ISO9692-1.

All pipe components shall be delivered with plastic end caps in order to avoid debris in the pipes, during transportation, storing and handling.

4.6.2 Site made branches

Delivery of each site made branch shall, at a minimum, include:

- One 90 degree steel pipe elbow
- One steel pipe stub piece
- One special joint kit
- Detailed instructions for the welding contractor.

Cutting main pipe casing and insulation, cutting a hole in main pipe, installation and welding of pipe stub and 90 degree elbow will be done by others.

4.7 Reducers

Reducers shall be delivered to the amount specified in Bill of Quantity.

Delivery shall comply with the requirements in EN448 as minimum. Pipe used for reducers shall comply with the requirements stated in clause 4.1.1.

Each pipe end shall be free of foam installation at a minimum length of 250 mm. Pipe ends shall be bevelled as specified in standard EN ISO9692-1.

All pipe components shall be delivered with plastic end caps in order to avoid debris in the pipes, during transportation, storing and handling.

4.8 Special fittings

Fittings and components of “special type” (other than described in this document) shall fulfil all applicable codes and standards.

If the Vendor chooses to offer special fittings then all details must be clearly specified in the bid.

4.9 Pre-insulated valves

Pre-insulated valves shall be delivered to the amount specified in Bill of Quantity.

Delivery shall comply with the requirements in EN488 as minimum. Pressure class for valves is minimum PN16. Suppliers of certified pre-insulated ball valve shall use so called S-valves (Strong).

Valves shall be designed for the extra large external forces created by thermal contraction and friction forces exerted from connected pipes. Axial forces calculations shall be based on ambient design temperature during installation and lowest operating temperature in accordance with clause 3.2.

Stem shall be fitted with a position indicator.

Total delivery of valves shall include 1 (one) manoeuvre device per gearbox dimension designed for operation from street level. Device shall be based on stem grip in appropriate size(s), wrench extension, gearbox and manoeuvre wheel.

For valves buried deeper than 2 meters, provide hydraulic actuators, hoses, control cabinet and auxiliaries as indicated on the drawings and Bill of Quantity.

4.9.1 Pre-insulated shut-off valves

Up to DN450, use steel ball valves with all-welded body and carbon reinforced Teflon seals.

DN500 and larger, use butterfly valves.

For valves DN400 and larger, provide DN 50 pre-insulated by-pass valves.

For valves DN200 and larger, provide gear boxes.

Stem shall be provided with double sealing, minimum two O-rings and the upper one shall be changeable from top.

Long stem ball valves where the extended stem is an integrated part of the valve is preferred.

Valves for connection to plots shall be equipped with venting valves.

All valves shall comply with requirements in EN488 as minimum.

Number of valves and types of valves; in accordance with the Bill of Quantity.

All valves shall be delivered with plastic end caps in order to avoid debris in the valves, during transportation, storing and handling.

4.9.2 Pre-insulated drain and venting valves

Only steel ball valves with all-welded body and carbon reinforced Teflon seals are accepted.

Ball valve shall comply with requirements in EN488 as minimum.

Stem shall be provided with double sealing, minimum two O-rings and the upper one shall be changeable from top.

Venting valves shall be designed as straight T-pieces with valve on top, pointing upwards. (Note that venting valves, when directly buried in the ground, if located at depth that makes it hard to reach handle from street level, shall be arranged horizontally and provided with a wrench extension (T-key).

4.10 Plastic warning devices

Plastic warning devices shall be delivered to the amount specified in Bill of Quantity.

Plastic warning devices will be rolled out and placed in the trench by the civil contractor, see detail drawing: Typical trench section LUS-CPALL-MAQ-DWG-UT-10301

5 MARKING, IDENTIFICATION AND TRANSPORTATION

5.1 Marking and identification

As an addition to requirements specified in codes and standards, each piece shall be marked in accordance with the Suppliers shop drawings and with a position number. The position number will be given by the Engineer prior to ordering.

Position numbers shall be sprayed on the jacket pipe at minimum two sides of each component for easy identification on site.

5.2 Transportation, delivery of material to the site

All delivery to the agreed site storage area shall be handled by and under the Supplier's responsibility.

In the event of damage caused under transportation or other defects in the material delivered, The Engineer reserves the right to reject such material and have it replaced with new material in good condition.

Unloading from trucks at the site will be carried out by others

6 DESIGN, PREPARATIONS AND TRAINING ON SITE

The high ambient temperature and bright sunlight must be considered during storage, transportation, and installation.

Site work shall include:

- Design and preparation of "surveillance drawings" showing control loops layouts including routings in branches and locations of circuit closings.

- Training of Contractor's installing personnel and the Engineer in surveillance system installation, testing and commissioning including issuing of certificates for persons after the successful education.
- Training of Contractor's installing personnel and the Engineer in outer casing pipe jointing and testing for each type of delivered joints including issuing of certificates for persons after the successful education.

7 QUALITY CONTROL

All quality control, inspection and testing shall be carried out in accordance with applicable and specified codes and standards.

A quality control system in accordance with the international standard ISO 9001 is preferred.

Products certified by independent body in accordance with official regulations are preferred and will be considered as an advantage in the Client's final evaluation of received tenders.

Vendor shall provide his quality control manual as part of the tender submission.

Supplier shall be able to document and demonstrate that all the activities related to quality throughout the process from confirmation of order to design, purchasing, manufacturing and delivery have been carried out in a properly monitored and organised fashion.

The Supplier shall give the Client at least 3 weeks notice of factory tests in order to give the Client a possibility to witness the tests.

8 WARRANTIES

All pipe material and components shall be covered by the Supplier's warranty for duration of 5 years following acceptance, in the form of a global insurance policy, covering damage of all types to the structure and with third party responsibility.

9 DOCUMENTATION

Supplier shall submit all documentation from quality control, inspection, and test reports. Mill certificates for all steel shall be submitted and sorted in good order.

Welder's qualification certificates from welding of pipe components shall be submitted.

Pipes and pipe components shall be marked for identification. Shop drawings with piece-marks shall be submitted.

Complete documentation for the surveillance system including design documents, commissioning documentation, and an instruction manual shall be delivered.

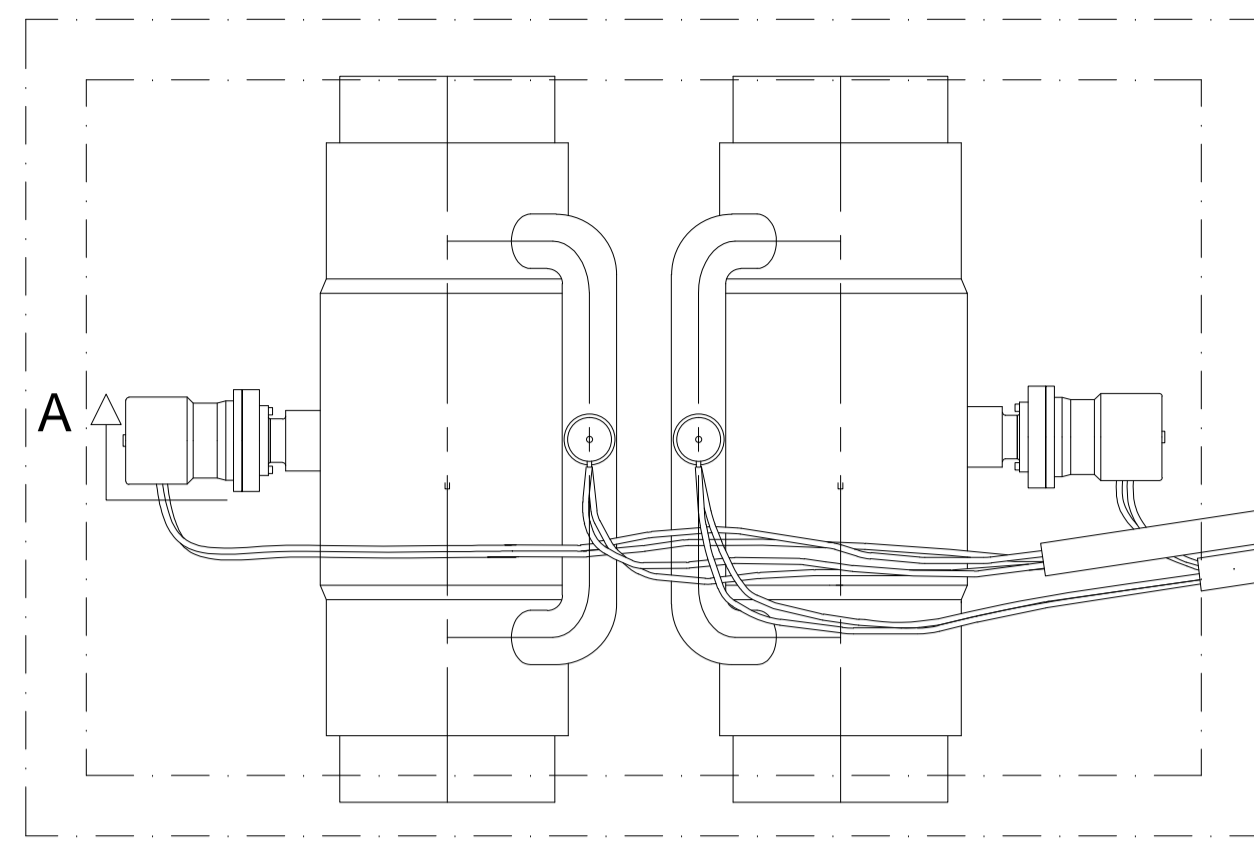
All documentation shall be delivered in minimum 5 sets hard copy plus 1 set soft copy.

10 APPENDICES AND DRAWINGS

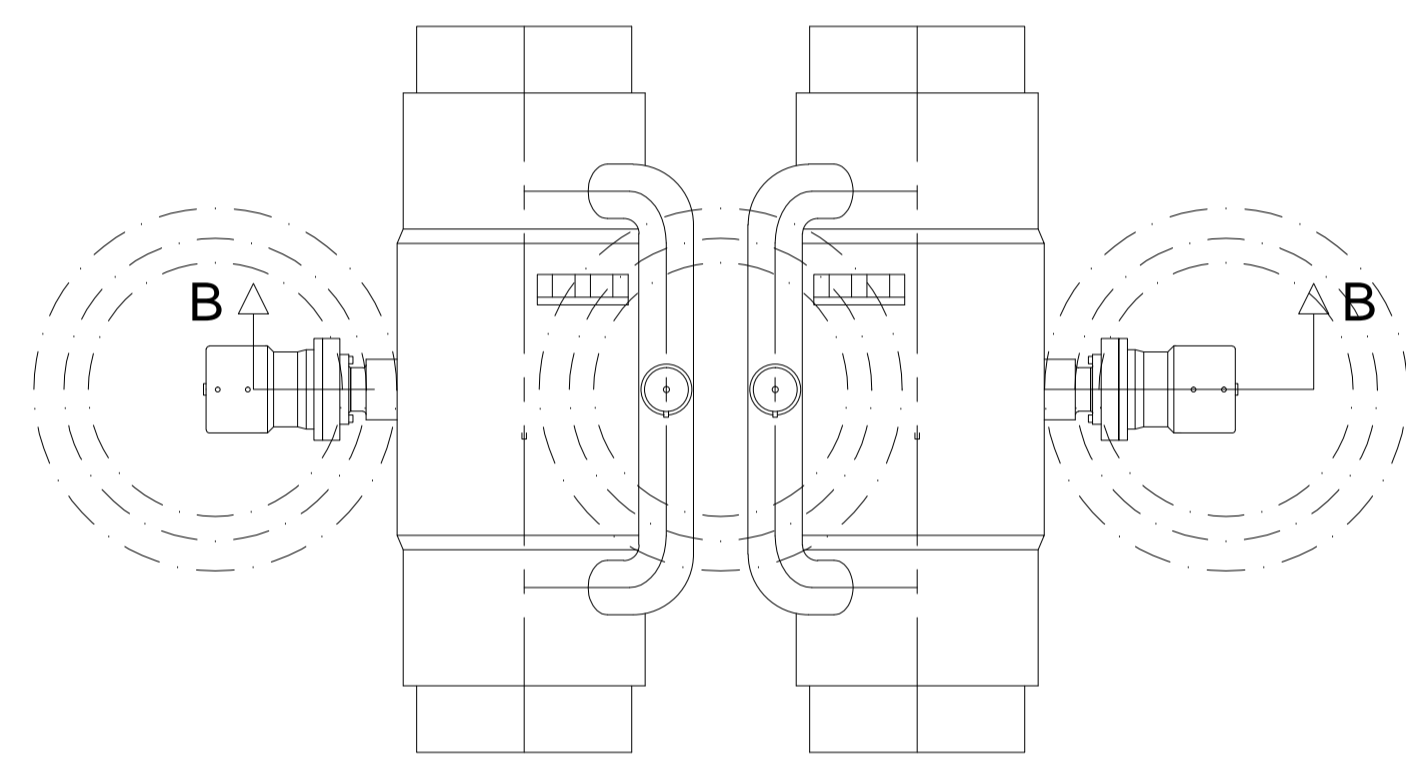
Appendices and applicable drawings are listed in the Drawings/Documents List form (DLF).

11 DRAWING / DOCUMENT LIST FORM

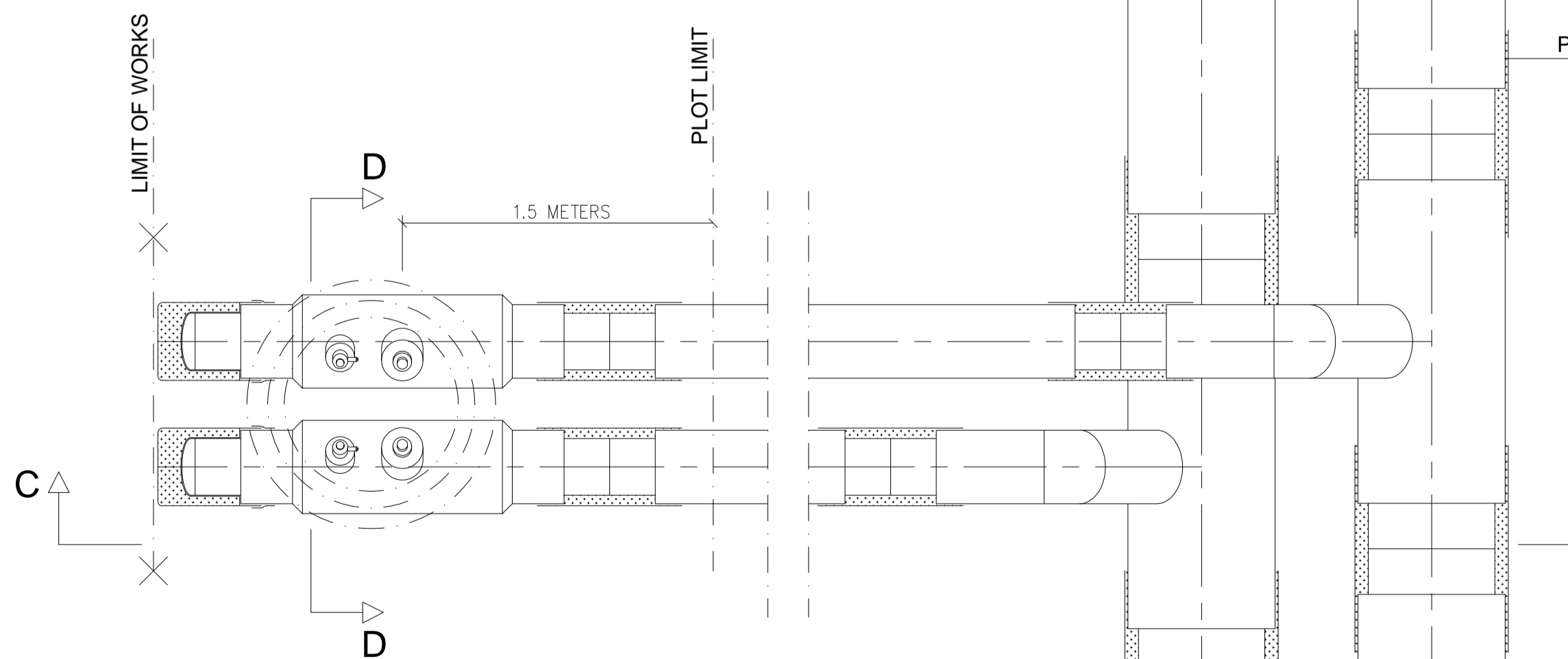
| DRAWINGS/DOCUMENTS LIST FORM (DLF) | | | |
|------------------------------------|----------------------------|--|----------|
| ITEM | DRAWING/DOCUMENT NUMBER | DRAWING/DOCUMENT TITLE | Revision |
| 01 | LUS-CPALL-MAQ-DWG-UT-10301 | DISTRICT COOLING-TYPICAL TRENCH AND TUNNEL SECTION | 0 |
| 02 | LUS-CPALL-MAQ-DWG-UT-10302 | DISTRICT COOLING-VALVE WITH HYDRAULIC ACTUATOR | 0 |



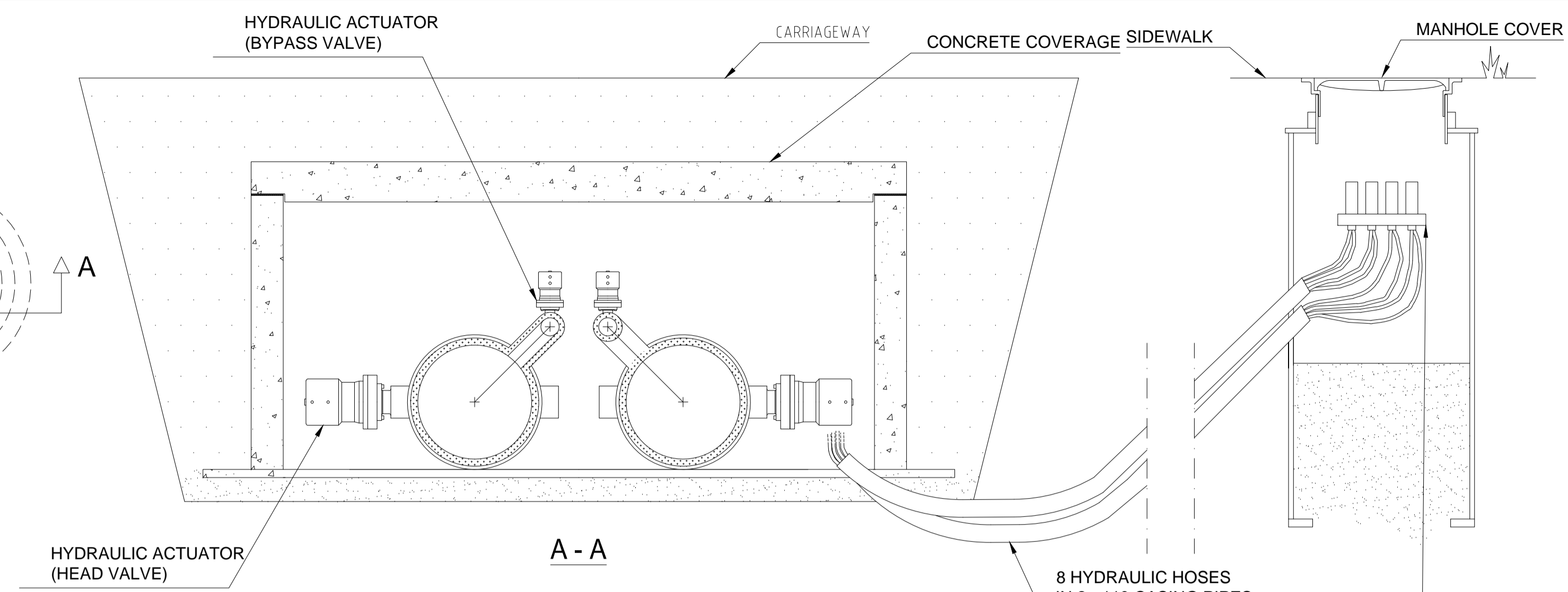
PREINSULATED VALVE WITH HYDRAULIC ACTUATOR AND BYPASS VALVE
ALTERNATIVE 1
NOT TO SCALE



PREINSULATED VALVE WITH HYDRAULIC ACTUATOR AND BYPASS VALVE
ALTERNATIVE 2
NOT TO SCALE

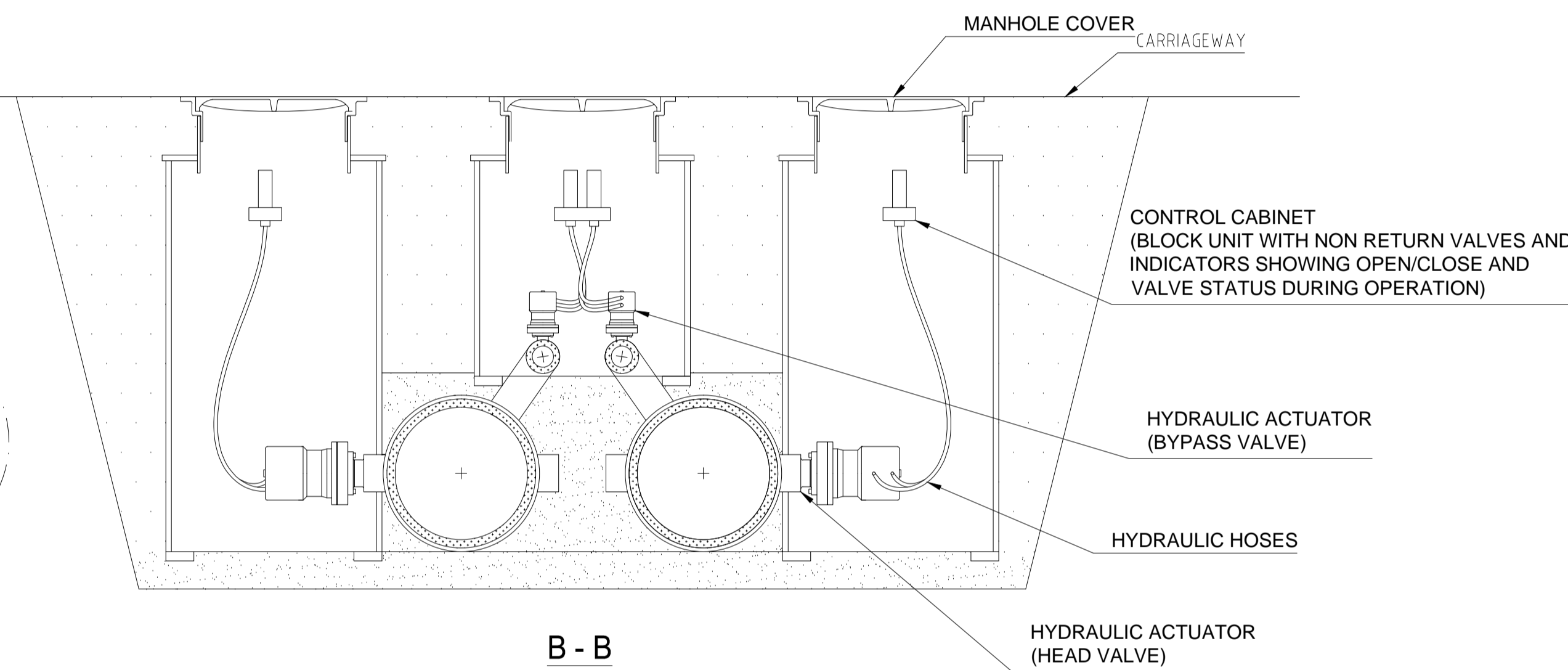


PREINSULATED SERVICE VALVES WITH VENTING VALVES AND TEMPORARY END FITTINGS
NOT TO SCALE

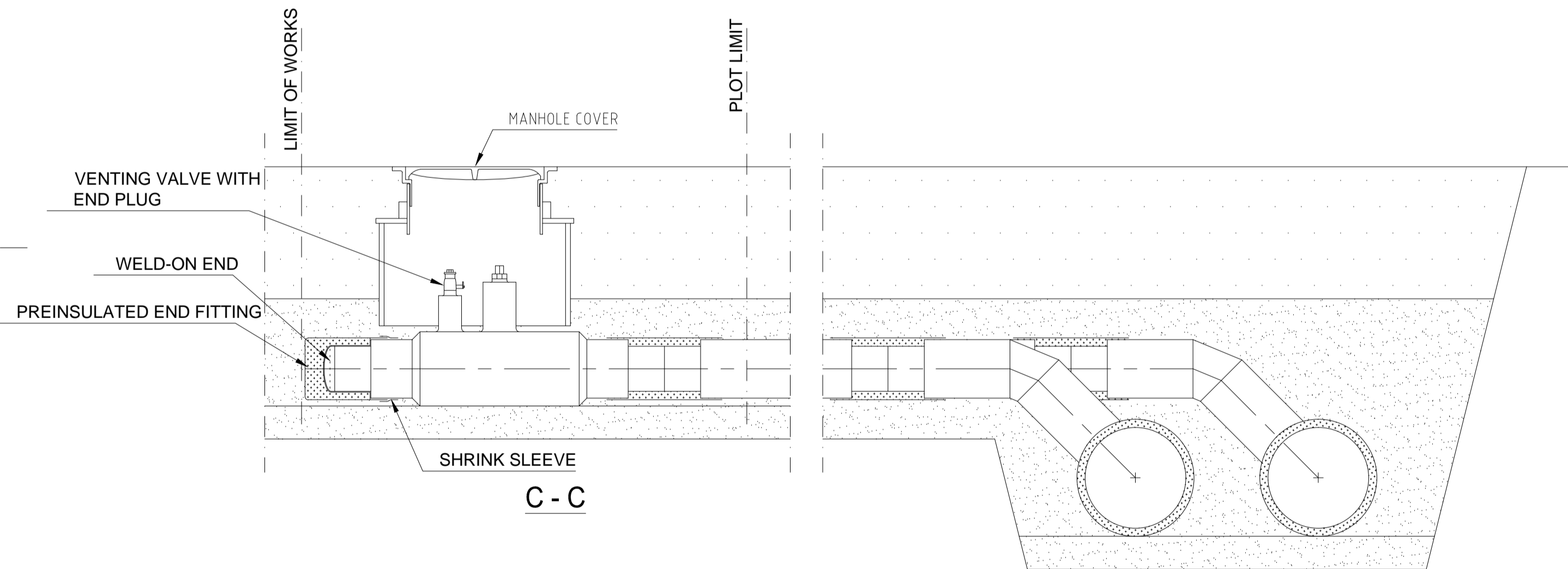


A - A

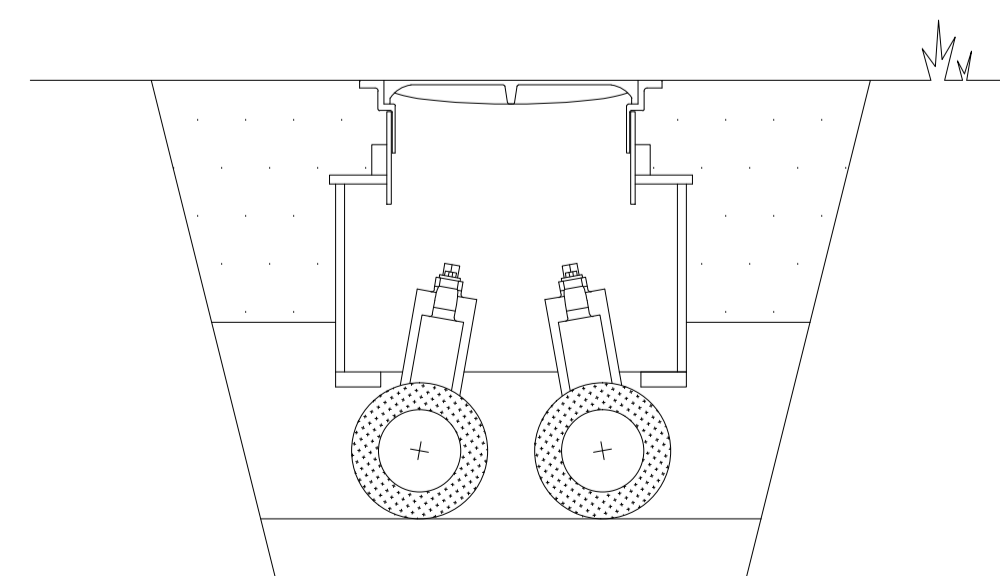
CONTROL CABINET
(BLOCK UNIT WITH NON RETURN VALVES AND INDICATORS SHOWING OPEN/CLOSE AND VALVE STATUS DURING OPERATION)



B - B



C - C



D - D

GENERAL NOTES

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TECHNICAL REQUIREMENT FOR CIVIL WORKS.
2. FOR TYPICAL TRENCH SECTION REFER TO DWG. LUS-CPALL-MAQ-DWG-UT-10301.

DRAWING REFERENCE:

| Rev | By | Chkd | Revised | Apprvd | Date | Description |
|-----|-----|------|---------|--------|--------|-------------|
| 0 | PKS | H.K. | A.A. | D.R. | 2.4.12 | REVIEW |

Client:



QATARI DIYAR
LUSAIL REAL ESTATE DEVELOPMENT COMPANY

Utilities Provider:



مرافق قطر
Marafiq Qatar

Project: LUSAIL DEVELOPMENT

Drawing Name: DISTRICT COOLING VALVE WITH HYDRAULIC ACTUATOR

| | | | |
|--------------|---------------------|-------|-------------|
| Drawn by: | NJB | Date: | 02-Apr-2012 |
| Checked by: | H.K. | Date: | 02-Apr-2012 |
| Reviewed by: | Abdullah Abushaikha | Date: | 02-Apr-2012 |
| Approved by: | D. R. PHILLIPS | Date: | 02-Apr-2012 |

Drawing No: LUS-CPALL-MAQ-DWG-UT-10302 Rev.: 0
Drawing Scale: NTS