

# **Guidelines for Excavation Works near the District Cooling System**

**March 2021**

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## 1 Introduction

These guidelines provide an outline of technical requirements relating to the excavation works near the District Cooling Systems (DCSs) which are implemented by Electrical and Mechanical Services Department (EMSD).

Other than the underground water pipe network, the DCS comprises central chiller plants and some may also comprise seawater pump rooms, box culvert and sea water pipelines.

The DCS pipe network and ancillary facilities (see Section 2) are all cleaned, chemical-treated and hydraulic-tested before commissioning. They should have a very long service life if they are not subsequently disturbed/damaged by any adjacent foundation works, road works or road opening activities. Common external factors relating to road opening works are:

- a) direct damage of the DCS pipe network and ancillary facilities by indiscriminate or reckless use of construction plant;
- b) ground settlement, vibration or movement caused by excavation or foundation works;
- c) disturbance of lateral or vertical support to the DCS pipe network; and
- d) excessive stress or loading caused by piling, blasting, heavy mechanical plant or construction traffic.

The permittee of an excavation permit and the nominated permittee (if any) in relation to the permit have legal obligations to protect all existing utility services, including the DCS pipe network and ancillary facilities, from any possible damage.

These guidelines are issued to help the permittee, the nominated permittee and/or the works contractor to avoid damage to the DCS pipe network and ancillary facilities, but compliance with these guidelines will not relieve them of any of their legal and/or contractual obligations.

For enquires relating to excavation works near the DCS pipe network and ancillary facilities, please contact our DCS service hotline at 2242 2777 (for Kai Tak Development) or 3912 0642 (for Kwu Tung North New Development Area and Tung Chung New Town Extension (East)).

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## 2 DCS Pipe Network and Ancillary Facilities

DCS pipe network and ancillary facilities (collectively called as DCS Equipment) are composed of:

a) Main Network

The main network is a 3-pipe system made up of black steel pipe annularly insulated with polyurethane foam and protected in a high density polyethylene (HDPE) cladding. Photo P1 in **Appendix A** shows part of the main network. The pipes are connected by welded joints. The three pipes are normally laid in one stack but when there is no enough space, they shall be laid in two stacks, i.e. "L" shape arrangement.

b) Tee-off Pipe from Main Network to Consumer

The tee-off pipe is of same material as the main network. Photo P2 in **Appendix A** shows an example arrangement of the tee off pipe. The tee off pipes are also connected by welded joints.

c) Sectional Valve Chamber

Valves are strategically placed on the main network to allow a certain section of the network to be isolated for maintenance and repair. The three valves are normally accommodated in one concrete chamber, with the provision of a cover for each valve. Details of the cover is shown in Sketch S4 in **Appendix A**.

d) Sub-station Valve Pit

A valve is placed on each tee-off pipe from the main network to the DCS substation in the consumer building. The three valves are normally accommodated in one concrete pit, with the provision of a cover for each valve. Details of the cover is shown in Sketch S4 in **Appendix A**.

e) Seawater Intake Culvert and Seawater Pipes

The seawater intake culvert from the seawall to the Seawater Pump Room generally has three cells. The seawater used as a cooling media is discharged to the sea by ductile iron outfall pipes.

f) Control Cable Ducts

uPVC/GI control cable ducts, which are used to accommodate optical cables for the DCS control system for data collection and transmission, run along with the DCS pipes. Draw pits of control cable ducts are provided. Details of the draw pit cover is shown in Sketch S4 in **Appendix A**.

Typical details of DCS Equipment are shown in **Appendix A** for reference.

### **3 Precautionary Measures for Safe Working near DCS Equipment**

The works contractor shall take all necessary measures to protect DCS Equipment near to his works. Any damage to the DCS Equipment will suspend the chilled water supply to the consumers. The works contractor should follow the procedures and practices described below for safe working near DCS Equipment and exercise due care to avoid causing damage to the DCS Equipment in execution of his works.

Please refer to **Appendix B** for the Conditions of Working in the Vicinity of DCS Equipment.

#### **3.1 Before Starting Excavation Works**

a) Request DCS Information from EMSD

The works contractor shall request the most up-to-date DCS information in the vicinity of his planned works from EMSD before commencing any excavation works.

b) Check Pipeline Alignment

The works contractor shall check the information provided by EMSD to note any existing DCS Equipment that may be affected by his planned works, before starting any excavation works. The works contractor shall take all necessary steps to prevent damage to the DCS Equipment.

c) Submission of Method Statement for Comment

The works contractor shall submit his method statements with the works programme, monitoring plan, protective measures, etc. to EMSD for comment.

d) Notification to EMSD

The works contractor shall inform EMSD at least 7 working days in advance of excavation works within 3 meters from the DCS Equipment or whenever there are uncertainties or problems regarding the locations and protection of DCS Equipment. Site meeting will be arranged if needed.

For enquires, the works contractor shall contact our DCS service hotline at 2242 2777 (for Kai Tak Development) or 3912 0642 (for Kwu Tung North New Development Area and Tung Chung New Town Extension (East)) immediately.

#### **3.2 Detection of DCS Equipment Location**

a) Application of Pipe Detector

The alignments and depths of buried DCS Equipment near the proposed works shall be ascertained as accurate as possible by a suitable pipe detector before digging trial holes.

b) Hand-dug Trial Holes

Trial holes shall be dug by hand tools to determine the exact locations of the DCS Equipment, before using mechanical plant for excavation.

c) Consult EMSD

EMSD shall be consulted if there are uncertainties or problems regarding the locations and protection of the existing DCS Equipment.

### **3.3 Execute the Works Safely**

a) Operation of Heavy Mechanical Plant

Heavy mechanical plant shall be operated carefully, especially in close proximity to the existing DCS Equipment. Excavation within 1 meter from the DCS Equipment should be carried out by hand digging method only. No excavator or heavy mechanical plant is allowed.

Pile driving (including sheet piling), boring, blasting and drilling on top of the DCS Equipment are not allowed. The works contractor shall consider the implications (e.g. settlement, vibration, etc.) on the DCS Equipment in its method statement when pile driving, boring, blasting and drilling are conducted in the vicinity of DCS Equipment.

No heavy mechanical plant is allowed to sit directly above the DCS Equipment when the soil cover to the DCS Equipment is less than 2 meters.

b) Vibration and Settlement Monitoring

Unless otherwise agreed in writing by EMSD, the following technical specification on vibration and settlement monitoring shall be applied.

The peak particle velocity and vibration amplitude of ground movements due to pile driving, boring, blasting or drilling as measured at the nearest DCS pipes and plant structures shall not exceed 25mm/s and 0.2mm respectively.

The peak particle velocity and vibration amplitude of ground movements due to pile driving, boring, blasting or drilling as measured at the nearest control cable, DCS valve chamber and valve pit shall not exceed 13mm/s and 0.1mm respectively.

If the above-mentioned limits of vibration are exceeded or movement in excess of 5mm is detected, works shall be suspended immediately until approved remedial works are completed. The works contractor is required to carry out investigation on any damages to DCS Equipment due to exceeding the limits of vibration or movement. Full details of the investigation report and the proposed remedial works shall be submitted to EMSD for comment.

The works contractor shall submit the method statement including the monitoring plan to EMSD for comment. The monitoring plan shall include the remedial and action plan in case the Alert, Action and Alarm levels stated in the monitoring plan being exceeded. The monitoring results of vibration and movement of the DCS Equipment and the DCS structures shall be submitted to EMSD for record purpose. If ground settlement is expected to be caused by the works, the predicted settlement contours and the assessment of the impact shall also be forwarded to EMSD for comment.

Vibration due to pile driving, boring, blasting, drilling or other construction activities shall be monitored by means of a vibrograph of agreed set up. The vibrograph to be used shall comply with the Specification below and shall be provided free by the works contractor.

Specification for Vibrograph:

- a. It is a direct reading type device.
  - b. It shall have 3 channels, recording readings in 3 mutually perpendicular directions.
  - c. It must be able to record particle velocity and amplitude, although not necessarily at the same time.
  - d. It must produce a permanent trace on paper, preferably by using ultra-violet light.
  - e. The recording paper must be easily obtainable locally.
  - f. The instrument must be portable and battery operated (or else a generator must be supplied free).
- c) Protective Measures

Protective measures shall be implemented to adequately support and protect the exposed DCS pipes, including the associated thrust blocks and valves.

Do not stockpile any materials above sectional valve chambers, sub-station valve pits and draw pits. Any construction debris that falls into the chambers or pits shall be cleared immediately.

Do not disturb or expose any thrust block without EMSD's prior agreement. Exposure of a thrust block without providing proper support may result in its movement and detachment of the associated pipe joints and eventually a burst. EMSD should be consulted on all cases where exposure of thrust blocks or DCS Equipment is required to enable suitable protective measures to be taken.

All temporary works near the DCS pipes of diameter equal to or larger than 500mm shall be kept at least 1m away from the edge of the DCS pipes. The length of the DCS pipes affected shall be well protected by a temporary timber cover raised 250mm clear of the DCS pipes to ensure no impact damage.

For plantation work with tree guard installation, the exact location and depth of the DCS Equipment shall be confirmed by hand-dug trial holes prior to the driving of the tree

guard into the ground to avoid causing damage to DCS Equipment underneath.

Do not expose the valves above general excavation level without protection. Proper fencing with warning signs should be provided to prevent accidental damage to the exposed valves by the swinging parts of the excavators.

Do not just use steel wire ropes or chain blocks to support the exposed DCS pipes. I beams/R.S.J. to be supported by piles or anchor blocks placed outside zone of subsidence should be used to provide proper vertical and lateral support to the exposed DCS pipes. Moreover, felt should be provided to surround the load-bearing surface to avoid stress concentrations.

Without approved ground support, no excavation shall be carried out within lines drawn at 45° downwards from a point 6m on plan from the outer edge of the foundation lines of any DCS structures including chambers and pits. Detailed design of the ground support with a detailed construction risk assessment that demonstrates negligible impact to the DCS Equipment shall be provided to EMSD for approval.

For excavation above the underground plant, attention must be drawn to ensure the stability of cut and fill areas, and the adequacy of temporary and permanent site drainage and suitable siting of discharge points.

d) Site Supervision and Control

Adequate site supervision and control shall be provided by the works contractor to ensure that all the above requirements and the requirements detailed in the method statements are closely observed.

Unobstructed access to DCS Equipment shall be maintained at all times for EMSD staff and his contractors to carry out inspection, operation, maintenance or repair works.

### 3.4 Backfilling

a) Checking before Backfilling

The works contractor shall notify EMSD to check that the DCS Equipment is in good condition before backfilling.

The works contractor shall reinstate the identification tapes, if removed when carrying out his works, on top of the DCS pipe network and control cable duct in accordance with Sketch S3 in **Appendix A**.

b) Backfilling

The requirement of backfilling shall comply with the General Specification for Civil Engineering Works published by the Government of the Hong Kong Special Administrative Region. The backfilling materials shall not contain any broken concrete, bricks, clay, bituminous material, materials susceptible to spontaneous combustion, perishable



materials, debris or sharp objects.

Typical details of backfilling is given in Sketch S5 in **Appendix A**. In general, a minimum thickness of 100mm of sand/granular fill has been provided below the DCS pipes. The same material has been used for backfilling to a level 300mm above the topmost DCS pipe. The works contractor should use sand/granular fill same as the existing backfill to reinstate the pipe trench.

The remaining portion shall then be backfilled with general fill to the formation level of the road in layers with adequate compaction to prevent ground settlement adjacent to or below existing DCS pipes.

### **3.5 Special Provisions**

EMSD may impose additional conditions as deemed necessary for the protection of DCS Equipment that may be adversely affected by the proposed works, including but not limited to the requirement of engaging an independent checking engineer by the works contractor to certify that the proposed excavation works will not affect the DCS Equipment.

## **4 Other Important Points**

### **4.1 No diversion of DCS Equipment**

No diversion of DCS Equipment is allowed unless it is proved to be unavoidable. The works contractor shall submit justifications of the proposed diversion and the method statement of diversion to EMSD for approval. The diversion works shall be carried out by an approved contractor under waterworks category or any other category of contractor to be approved by EMSD.

Valves shall not be operated without prior approval from EMSD. Unauthorized operation of valves may cause suspension of the chilled water supply to consumers.

### **4.2 Insulation and Cladding**

The main DCS pipe network and tee-off pipes are enclosed by insulation and HDPE cladding. The insulation is used to reduce the heat gain from the soil to the cold chilled water. The HDPE cladding is used to protect the main DCS pipe network and tee-off pipes from external impact and prevent ground water ingress, etc. Any damage to the insulation and HDPE cladding will cause unwanted heat gain, energy waste and corrosion due to exposure to ground water, thus shortening the service life of the DCS pipe network.

EMSD shall be informed of any damage of the insulation or the cladding.

### **4.3 Control Cable Duct**

uPVC/GI control cable ducts are installed along the DCS pipe network for instantaneous data collection, transmission and system monitoring. If the control cable is damaged, it will not be

able to control and monitor the DCS, hence the quality of chilled water supply cannot be maintained. EMSD shall be informed of any damage to the control cable ducts.

#### **4.4 Soil Cover to DCS Pipe Network**

The DCS pipes generally have a minimum cover of 1.1m and 1.5m beneath footpaths and carriageways respectively, measured from the existing ground level to the crown of the DCS pipe.

#### **4.5 Exposure of DCS Pipe Network**

EMSD shall be consulted in all cases when exposure of thrust blocks, DCS pipe network and Equipment are required. The works contractor shall ensure that the exposed items are properly protected.

#### **4.6 Planting near DCS Equipment**

If the excavation works are for tree/shrub planting, a minimum separation between the tree/shrub and DCS Equipment shall be kept. The minimum separation depends on the type of tree/shrub to be planted. The root of tree/shrub shall not affect the DCS Equipment. The design shall be submitted to EMSD for comment.



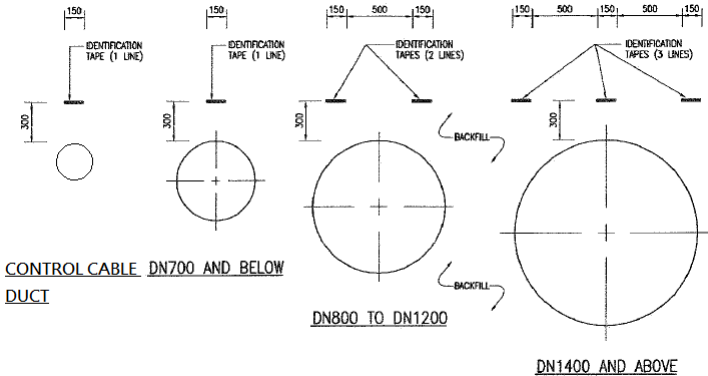


### **5 Reporting of DCS Equipment Damage or Pipe Leakage Immediately to EMSD**

In case that damage or leakage of the DCS Equipment is discovered in the vicinity of the excavation works, the works contractor should report immediately to our DCS service hotline at 2242 2777 (for Kai Tak Development) or 3912 0642 (for Kwu Tung North New Development Area and Tung Chung New Town Extension (East)).

A flowchart on procedures for safe working near DCS Equipment is attached in **Appendix C** for information.

# **Appendix A**

## **Typical Details of DCS Pipe Network and Ancillary Facilities**

Sketches	Photos
	 <p>P1: DCS Pipe Network</p>
	 <p>P2: Tee-off Pipe from Main Network to Consumer</p>
 <p>S3: Typical position of identification tape</p>	 <div data-bbox="965 1355 1364 1456" style="background-color: #0070C0; color: white; padding: 5px;">  小心 - 機電工程署區域製冷喉管 CAUTION - EMSD DCS SERVICES         </div> <p>P3: Identification tape</p>



# **Appendix B**

## **Conditions of Working in the Vicinity of DCS Equipment**

### Conditions of Working in the Vicinity of DCS Equipment

1. The works contractor shall check the locations of DCS Equipment by a suitable pipe detector, then by hand-dug trial holes.
2. If the DCS Equipment will be affected by the excavation works, the works contractor shall submit its proposal of protective measures and temporary works to its Client or Client Representatives for approval and to EMSD for comment. Works shall not be commenced until approval is given by its Client or Client Representatives.
3. All excavation works within 1 meter from the DCS Equipment shall be carried out by hand tools.
4. No heavy mechanical plant is allowed to sit directly above the DCS Equipment when the soil cover to the DCS Equipment is less than 2 meters.
5. The exposed DCS Equipment due to the excavation works shall be properly protected. Proper fencing with warning signs should be provided to prevent accidental damage to the exposed valves by the swinging parts of the excavators. EMSD shall be consulted in all cases when exposure of thrust blocks or the DCS Equipment is required.
6. Do not stockpile any materials above sectional valve chambers, sub-station valve pits and draw pits.
7. All temporary works near the DCS pipes of diameter equal to or larger than 500mm shall be kept at least 1m away from the edge of the DCS pipes. The length of the DCS pipes affected shall be well protected by a temporary timber cover raised 250mm clear of the DCS pipes to ensure no impact damage.
8. The exact location and depth of the DCS Equipment shall be confirmed by hand-dug trial holes prior to the driving of the tree guard into the ground to avoid causing damage to DCS Equipment underneath.
9. If the excavation works are for tree/shrub planting, a minimum separation between the tree/shrub and DCS Equipment shall be kept. The minimum separation depends on the type of tree/shrub to be planted. The root of tree/shrub shall not affect the DCS Equipment. The design shall be submitted to EMSD for comment.
10. Any construction debris that falls into the chambers or pits shall be cleared immediately.
11. I beams/R.S.J. to be supported by piles or anchor blocks placed outside zone of subsidence should be used to provide proper vertical and lateral support to the exposed DCS pipes. Moreover, felt should be provided to surround the load-bearing surface to avoid stress concentrations.
12. Valves shall not be operated without prior approval from EMSD.
13. Unobstructed access to DCS Equipment shall be maintained at all times for EMSD staff and his contractors to carry out inspection, operation, maintenance or repair works.
14. Without approved ground support, no excavation shall be carried out within lines drawn at 45° downwards from a point 6m on plan from the outer edge of the foundation lines of any DCS

structures including chambers and pits. Detailed design of the ground support with a detailed construction risk assessment that demonstrates negligible impact to the DCS Equipment shall be provided to EMSD for approval.

15. For excavation above the underground plant, attention must be drawn to ensure the stability of cut and fill areas, and the adequacy of temporary and permanent site drainage and suitable siting of discharge points.
16. The works contractor shall notify EMSD to check that the DCS Equipment is in good condition before backfilling.
17. The works contractor shall reinstate the identification tapes, if removed when carrying out his works, on top of the DCS pipe network and control cable duct in accordance with Sketch S3 in **Appendix A**.
18. EMSD shall be consulted if there is any change in the depth of cover from the ground level to the crown of the DCS pipe after reinstatement of excavation.
19. The DCS pipes generally have a minimum cover of 1.1m and 1.5m beneath footpaths and carriageways respectively, measured from the existing ground level to the crown of the DCS pipe.
20. No diversion of DCS Equipment is allowed unless it is proved to be unavoidable. The works contractor shall submit justifications of the proposed diversion and the method statement of diversion to EMSD for approval.
21. If there is any damage caused to DCS Equipment, the works contractor shall report immediately to our DCS service hotline at 2242 2777 (for Kai Tak Development) or 3912 0642 (for Kwu Tung North New Development Area and Tung Chung New Town Extension (East)).
22. No earth fill ramps are to be used to form temporary crossings above DCS pipe network to avoid any unaccounted for loading from being imposed on the DCS pipes.
23. EMSD may impose additional conditions as deemed necessary for the protection of DCS Equipment that may be adversely affected by the proposed works, including but not limited to the requirement of engaging an independent checking engineer by the works contractor to certify that the proposed excavation works will not affect the DCS Equipment.

#### **Blasting, Drilling and Piling near DCS Equipment**

24. Pile driving (including sheet piling), boring, blasting and drilling on top of the DCS Equipment are not allowed. The works contractor shall consider the implications (e.g. settlement, vibration, etc.) on the DCS Equipment in its method statement when pile driving, boring, blasting and drilling are conducted in the vicinity of DCS Equipment.
25. The peak particle velocity and vibration amplitude of ground movements due to pile driving, boring, blasting or drilling as measured at the nearest DCS pipes and plant structures shall not exceed 25mm/s and 0.2mm respectively.
26. The peak particle velocity and vibration amplitude of ground movements due to pile driving,



boring, blasting or drilling as measured at the nearest control cable, DCS valve chamber and valve pit shall not exceed 13mm/s and 0.1mm respectively.

27. If the above-mentioned limits of vibration are exceeded or movement in excess of 5mm is detected, works shall be suspended immediately until approved remedial works are completed. Full details of the investigation report and the proposed remedial works shall be submitted to EMSD for comment.
28. The works contractor shall submit the method statement including the monitoring plan to EMSD for comment. The monitoring plan shall include the remedial and action plan in case the Alert, Action and Alarm levels stated in the monitoring plan being exceeded. The monitoring results of vibration and movement of the DCS Equipment and the DCS structures shall be submitted to EMSD for record purpose. If ground settlement is expected to be caused by the works, the predicted settlement contours and the assessment of the impact shall also be forwarded to EMSD for comment.
29. Vibration due to pile driving, boring, blasting, drilling or other construction activities shall be monitored by means of a vibrograph of agreed set up. The vibrograph shall be provided free by the works contractor.

- END -

**Appendix C**

**Flowchart on Procedures for  
Safe Working  
near DCS Equipment**

**Appendix C - Flowchart on Procedures for Safe Working near DCS Equipment**

