GENERAL

This document contains the basic technical information for Architectural, Civil & Structural and M&E Building Services as required by supplier to achieve optimum DHCS operation.

The time frame required for the completion of the DHCS customer station works is six(6) months prior to the official date of turn on of the chilled/hot water supply.

1.0 CONDITIONS FOR CHILLED WATER SUPPLY (PRIMARY SIDE BY DHCS SUPPLIER)

1.1 CHILLED WATER TEMPERATURE AND PRESSURE

1.1.1 Chilled Water Supply Temperature

The averaging temperature of supply chilled water measured at the sensing point on the supply side of the measuring unit shall be as followings:

	Standard Temp	Allowable Range
Chilled Water	7.0 °C	7.0 ± 1°C

1.1.2 Chilled Water Return Temperature

The averaging temperature of return chilled water measured at the sensing point on the return side of the measuring unit shall be as followings:

	Standard Temp	Allowable Range
Chilled Water	14.0 °C	14.0 ± 1 °C

1.1.3 Chilled Water Pressure

Generally, the pressure in the distribution pipe will be varied from 5.0 kg/cm²G to 10.0 kg/cm²G (Plant's setting value) depending on distance run and geographical position of underground pipes.

1.2 CONTROL

1.2.1 Cooling Demand Load Management

In order to maintain stable chilled water supply to all customers, when the DHCS sense a customer demand load exceeding the declared demand beyond a preset limit, the chilled water flow may be restricted by operating a control valve. This is to minimize overused of chilled water load beyond the declared load.

1.2.2 Return Chilled Water Temperature Control

The return chilled water will be restricted by operating a control valve so that the temperature of the water can be maintained at 13°C and above, measured at the sensing point on the return side of the measuring unit.

2.0 DESIGN CRITERIA FOR CUSTOMER'S AIR-CONDITIONING SYSTEM (SECONDARY SIDE BY CUSTOMER)

2.1 TEMPERATURE AND PRESSURE

2.1.1 Supply Chilled Water Temperature

Secondary supply chilled water temperature after heat exchangers shall be maintained by CUSTOMER at 8.0±1°C.

2.1.2 Return Chilled Water Temperature

Secondary return chilled water temperature shall be maintained by CUSTOMER to 15±1°C.

2.1.3 Pressure of Chilled Water

Secondary distribution chilled water system by CUSTOMER connected to DHCS after heat exchanger shall not exceed 10 kg/cm²G.

2.2 AHU/FCU AND CONTROLS SETTINGS

- Supply chilled water temperature : 8.0±1°C
- Return : 15±1°C
- Chilled water control : 2-way valve control
- 2-way valve shall be closed during shut-down of AHU/FCU operation

To prevent the in rush of chilled water from the heat exchangers when all AHUs / FCUs are turn on simultaneously, it is necessary to implement daily timed sequential start-up operation strategy for all AHUs / FCUs. This would reduce the chance of chilled water consumption exceeding the declared peak cooling demand.

3.0 CONDITIONS FOR HOT WATER SUPPLY (PRIMARY SIDE BY DHCS SUPPLIER)

3.1 HOT WATER TEMPERATURE AND PRESSURE

3.1.1 Hot Water Supply Temperature

The averaging temperature of hot water supply measured at the sensing point on the supply side of the measuring unit shall be as followings:

	Supply Temperature	Tolerance
Hot Water	80 °C	± 1°C

3.1.2 Hot Water Return Temperature

The averaging temperature of hot water return measured at the sensing point on the return side of the measuring unit shall be as followings:

	Return Temperature	Tolerance
Hot Water	60 °C	± 1 °C

3.1.3 Hot Water Pressure

Generally, the operating pressure in the distribution pipe will be varied from 5.0 kg/cm²G to 10.0 kg/cm²G (Plant's setting value) depending on distance run and geographical position of

underground pipes.

3.2 CONTROL

3.2.1 Hot Water Demand Load Management

In order to maintain stable hot water supply to all customers, when the DHCS sense a customer demand load exceeding the declared demand beyond a preset limit, the hot water flow may be restricted by operating a control valve. This is to minimize overused of hot water load beyond the declared load.

3.2.2 Return Hot Water Temperature Control

The return hot water will be restricted by operating a control valve so that the temperature of the water can be maintained at 50°C and below, measured at the sensing point on the return side of the measuring unit.

4.0 DESIGN CRITERIA FOR CUSTOMER'S SPACE HEATING SYSTEM (SECONDARY SIDE BY CUSTOMER)

4.1 TEMPERATURE AND PRESSURE

4.1.1 Hot Water Supply Temperature

Secondary hot water supply temperature after heat exchangers shall be maintained by CUSTOMER at 60.0±1°C.

4.1.2 Hot Water Return Temperature

Secondary hot water return temperature shall be maintained by CUSTOMER at 50±1°C.

4.1.3 Pressure of Hot Water

Secondary distribution hot water system by CUSTOMER connected to DHCS after heat exchanger shall not exceed 10 kg/cm²G.

4.2 RADIATOR/ DUCT COIL CONTROLS SETTINGS

* Supply Hot water temperature : 60.0±1°C
* Return : 50.0±1°C
* Hot water control : 2-way valve control
* 2-way valve shall be closed during shut-down of Radiator/Duct coil operation

To prevent the in rush of hot water from the heat exchangers when all Radiator/Duct Coils are turn on simultaneously, it is necessary to implement daily timed sequential start-up operation strategy for all Radiators / Duct Coils. This would reduce the chance of hot water consumption exceeding the declared peak heating demand load.

5.0 CHILLED/HOT WATER PUMP

In order to maintain return chilled/hot water temperature within the tolerance, variable water flow control with constant water temperature shall be provided. A variable speed pump system is required to achieve this operation. The variable speed pump system shall be calibrated to deliver optimum flow to prevent energy wastage.

CUSTOMER is required to size up the variable speed pump(s) to take care of the minimum cooling/heating load requirement during off-peak hours (which should be made known to the DHCS supplier during the design stage).

6.0 DHCS CUSTOMER STATION LAYOUT

Room space requirement to be advised by DHCS.

7.0 SCOPE OF WORKS BETWEEN DHCS SUPPLIER (DHCS) AND CUSTOMER

The Developer shall officially hand-over the DHCS customer station to the DHCS SUPPLIER six (6) months prior to the official date of turn on of the chilled/hot water.

The DHCS customer station shall fulfill the requirements under the scope of works by Developer as specified below, prior to the official hand-over to the DHCS SUPPLIER.

	Item	**Constructed By**	**Paid by**	**Remarks**
1	DHCS customer station structure and finish work	Developer	Developer	Refer to **Note 1**
2	Chilled/Hot water pipe-work up to the DHCS customer station	DHCS	DHCS	Refer to **Fig. 1** & **Fig. 2**
3	Ditto support work	DHCS	DHCS	
4	Ditto penetration galvanized steel pipe sleeves & sleeve external water tight work	Developer	Developer	Refer to **Fig. 3**
5	Secondary pipework & support	Developer	Developer	
6	DHCS Instruments panels, remote transmission cabinets & power distribution cabinets	DHCS	DHCS	
7	Concrete plinth work	Developer	Developer	Refer to **Note 1**
8	Carry-in & installation	DHCS	DHCS	
9	Terminals installation for instruments	DHCS	DHCS	
10	Branch off valve	DHCS	DHCS	
11	Measuring meters	DHCS	DHCS	
12	Thermal insulation/painting work for equipment	DHCS	DHCS	
13	Electric power supply equipment for DHCS customer station and lighting fixture (eg. Distribution board, control panels, isolator & etc.)	Developer	Developer	Refer to **Note 4**

	Item	Constructed By	Paid by	Remarks
14	2 nos of metal clad switch socket with RCCB	Developer	Developer	Refer to **Fig. 4**
15	Emergency Power Requirement	Developer	Developer	Refer to **Note 5**
16	Black Out Signal and power recovery signal	Developer	Developer	Refer to **Note 6**
17	DHCS customer station equipment pressure test	DHCS	DHCS	
18	DHCS customer station pipe flushing/cleaning up	DHCS	DHCS	Primary side only
19	Ventilation in the DHCS customer station	Developer	Developer	Refer to **Note 2**
20	Facilities for water supply/drainage in the DHCS customer station	Developer	Developer	Refer to **Note 3**
21	Fire alarm/fire fighting system of DHCS customer station room	Developer	Developer	
22	Two direct telephone line for DHCS metering terminated inside room	Developer	Developer	
23	DHCS Equipment Lifting Hooks, Anchor Bolted Hooks. Each hook shall be designed to carry 1 no. of heat exchanger loading	Developer	Developer	
24	Temporary lifting in opening to facilitate movement of heat exchangers into customer station	Developer	Developer	Opening size to be advised by DHCS. Patching of opening by the Developer
25	A normally closed by-pass pipe connecting the secondary chilled/hot water supply and return piping. This pipe shall be installed in secondary pump room for secondary side water flushing purpose.	Developer	Developer	Refer to **Note 7**
26	Secondary pumps on/off signal	Developer	Developer	Refer to **Note 8**
27	On/off motorized valves at secondary chilled/hot water circuit & interfacing cables if common header pipe is installed inside secondary pump room.	Developer	Developer	Refer to **Note 9**
28	Chilled/Hot Water Quality & Water treatment at secondary side	Developer	Developer	Refer to **Note 10**

Note 1: Requirements on architectural works

Internal finish schedule in the DHCS customer station

Standard finish schedule is shown below. Reasonable finish schedule used by Developer for other machine rooms (such as secondary pump station) can be considered.

Floor	:	Mortar smooth finish with dust proof epoxy paints
Baseboard	:	Ditto
Wall	:	Mortar smooth finish with resin paint
Ceiling	:	Insulation coating required if condensation occurred
Door size	:	1,500mm (W) double leaf door x 2,500mm (H) with key lock

If there is a room underneath the DHCS customer station, floor water proofing shall be required.

Concrete plinth (with rein-bar) for equipment

Dust proof epoxy paint required for concrete plinth.

Details to be provided by DHCS

Coordination will be required during detailed design and construction stage.

Note 2: Requirements for DHCS customer station ventilation

Ventilation rate: 8 air change per hour

Fresh air shall be supplied directly from outdoor through fresh air duct to the DHCS customer station (by Developer)

Fresh air duct shall be installed up to inside of the wall opening (by Developer)

For exhaust from DHCS customer station to the outdoor, exhaust fan, ductwork and wall openings shall be provided by Developer.

No ductwork shall be run within room, wall grilles shall be provided to terminate on room wall. Air grilles shall be sized to not exceeding 3 m/s air velocity.

Coordination will be necessary during detailed design and construction stage.

Note 3: Requirements on water supply and drainage in the DHCS customer station

The DHCS customer station shall be provided with adequate drainage facilities to convey water out of the room. If a sump pit is provided, it shall be furnished with submersible sump pump for quick draining of water. The sump pit shall be covered with galvanized steel grating.

Sump pump operation shall be controlled automatically by float switches and manual activation. The alarm signal shall be monitored by the Building Automation System.

Floor mounted mop sink (minimum size 500 mm x 600 mm x 300 mm high) of either stainless steel or tiled concrete with diameter 15mm hose tap and bib shall be provided. Sink drain 50 mm diameter shall be fitted with stainless steel mesh strainer and drain stopper completes with stainless steel chain.

A water meter shall be provided to monitor consumption of water.

Drain hoppers or micro-sumps with grating cover shall be provided for heat exchangers

draining.

Coordination shall be required during detailed design and construction stage. Water proofing of floor slab, insulation of drainage pipe will be required if there is any basement floor below the DHCS customer station.

Note 4: Requirements on electricity & Lighting

Electricity shall be supplied to DHCS customer station with distribution / isolating switchboard by Developer. A electricity sub meter shall be provided by developer to monitor electricity consumption.
Specifications: 3 phase 4 wire 50A. Refer to **Fig. 4** for a typical wiring diagram.
Room shall be illuminated to at least 500 lux level. Internal lighting fixtures, receptacles, ventilation fans and sump pumps shall be provided by Developer.
Coordination will be required during detailed design and construction stage.

Note 5: Requirements on emergency electricity supply

Emergency power supply of minimum 1000VA shall be provided by the Developer. This emergency electricity supply shall kick in upon power failure to sustain the operation of the controls and instrumentation in the DHCS customer station.
The emergency power supply shall supply to a distribution board, control panel or isolator. Please refer to **Fig. 4** for a typical wiring diagram.

Note 6: Black-Out Signal and power recovery signal

The Developer shall provide a black-out and power recovery signal(s) to notify DHCS in the event of power failure and power recovery. Please refer to **Fig. 4** for a typical black-out/recovering signal circuit diagram.
The Developer shall provide similar or equivalent circuit for monitoring power in the DHCS customer station.

Note 7: By-pass Pipes for Flushing

Developer shall install by-pass pipes at their secondary side chilled/hot water piping system to prevent contamination of heat exchangers during chemical flushing. The by-pass pipe shall be installed near to the flange installed by DHCS. The water quality shall be within a reasonable quality acceptable by DHCS before water is allowed to enter into the heat exchangers. Side stream water filtration devices are recommended to install by developer.

Note 8: Secondary Pumps on/off Signal

To ensure proper interlocking between the chilled/hot water demand by Developer and the supply by DHCS, Developer shall provide pump (s) operation signal to DHCS, so as to trigger the supply of chilled/hot water at the primary side of the heat exchanger(s). This signal shall tap from a non-voltage dry contact, when pump(s) operates the contact shall be closed. The signal wiring shall be wired and terminated at the DHCS room control panel as provided by DHCS.

Note 9: On/Off motorized valves

Developer shall install on/off motorized valves at secondary side chilled/hot water circuit if common header pipe is provided inside secondary chilled/hot water pump room due to space constraint (or) pumps configuration. This is to ensure chilled/hot water supply temperature at secondary side is maintained within the specification while only one unit of heat exchanger is operating during the low cooling/heating load. Respective On/off motorized valves shall react according to the feedback signal receive from DHCS. The developer shall connect all interfacing cables to the automatic control panel located inside DHCS room.

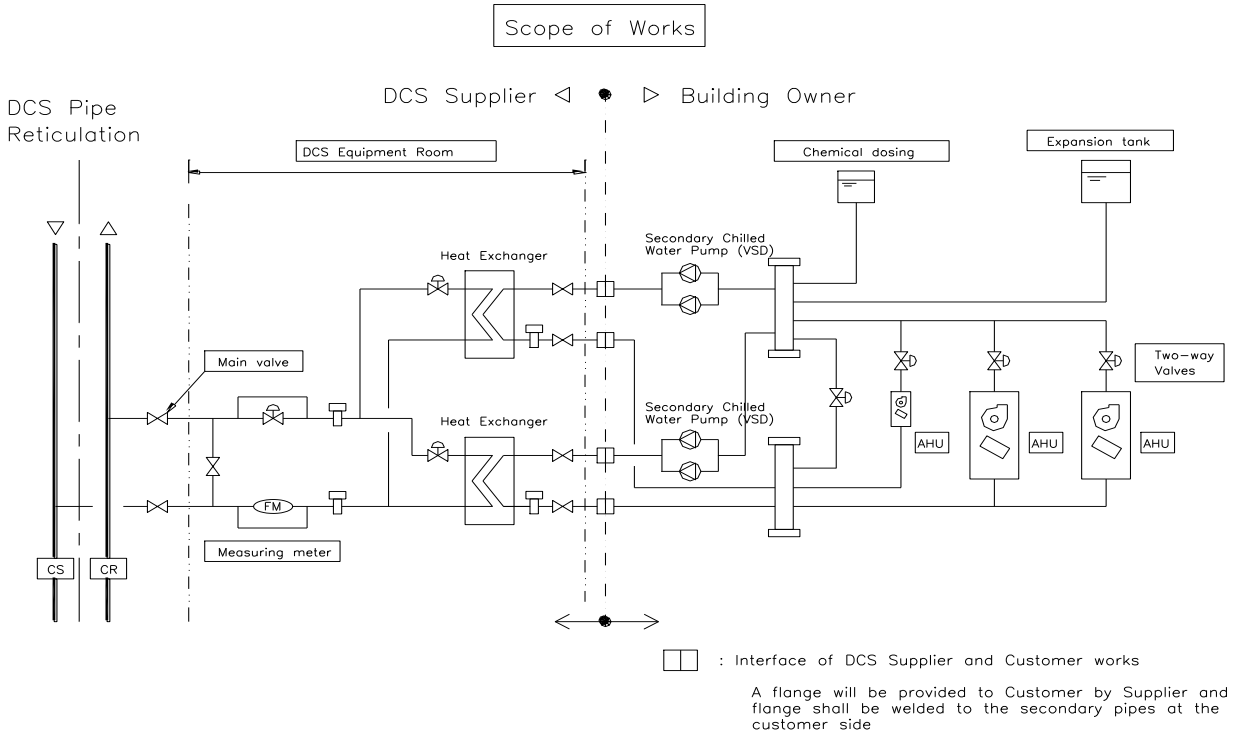
Note 10: Water Quality Standard

In order to prevent corrosion and fouling to the piping and heat exchanger systems, customer must ensure proper flushing, passivation and water treatment to be carried out by water treatment specialist on the secondary chilled/hot water pipe work system to meet the following water quality control parameters, and the water quality test report must be at least 3 days prior to turn on of DHCS chilled/hot water. Developer shall engage competent water treatment specialist to maintain the water quality throughout the live operation of air conditioning & space heating system. Scheduled circulation of chilled/hot water and monitoring of water quality will be required during fit-out (tenant) work before the building is in full operation:

Essential Items	**Application**	**Range of Index**	Affect to	
			Corrosion	Scaling
PH (25°C)	Chilled/Hot	7 - 10.0	○	
Electrical conductivity (□S/cm) at 25°C	Chilled/Hot	<2500	○	
Chloride ion (mgCL/l)	Chilled/Hot	<50	○	
Sulfuric acid ion (mgSO4/l)	Chilled/Hot	=<50	○	
Acid consumption PH 4.8 (mgCaCO3/l)	Chilled/Hot	=<50		○
Calcium Hardness (mgCaCO3/l)	Chilled/Hot	=<70		○
Silica (mgSiO2/l)	Chilled/Hot	=<30		○
Fe (mgFe/l)	Chilled/Hot	<5.0	○	○
Total Phosphate (PO4)	Chilled/Hot	>5	○	
Nitrite Ion (mg/l as NO2)	Chilled/Hot	>500(Hot), >190(Chilled)	○	
Turbidity (Degree)	Chilled/Hot	<20	○	

FIGURE 1: Chilled Water System Flow Sheet for DHCS customer station and CUSTOMER Building (Recommended)

Fig. 1: Division of Responsibility Between DCS Supplier & Building Owner



Note: All secondary chilled water pipe and airside equipment installations shall be outside the scope of DCSC

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FIGURE 2: Hot Water System Flow Sheet for DHCS customer station and CUSTOMER Building (Recommended)

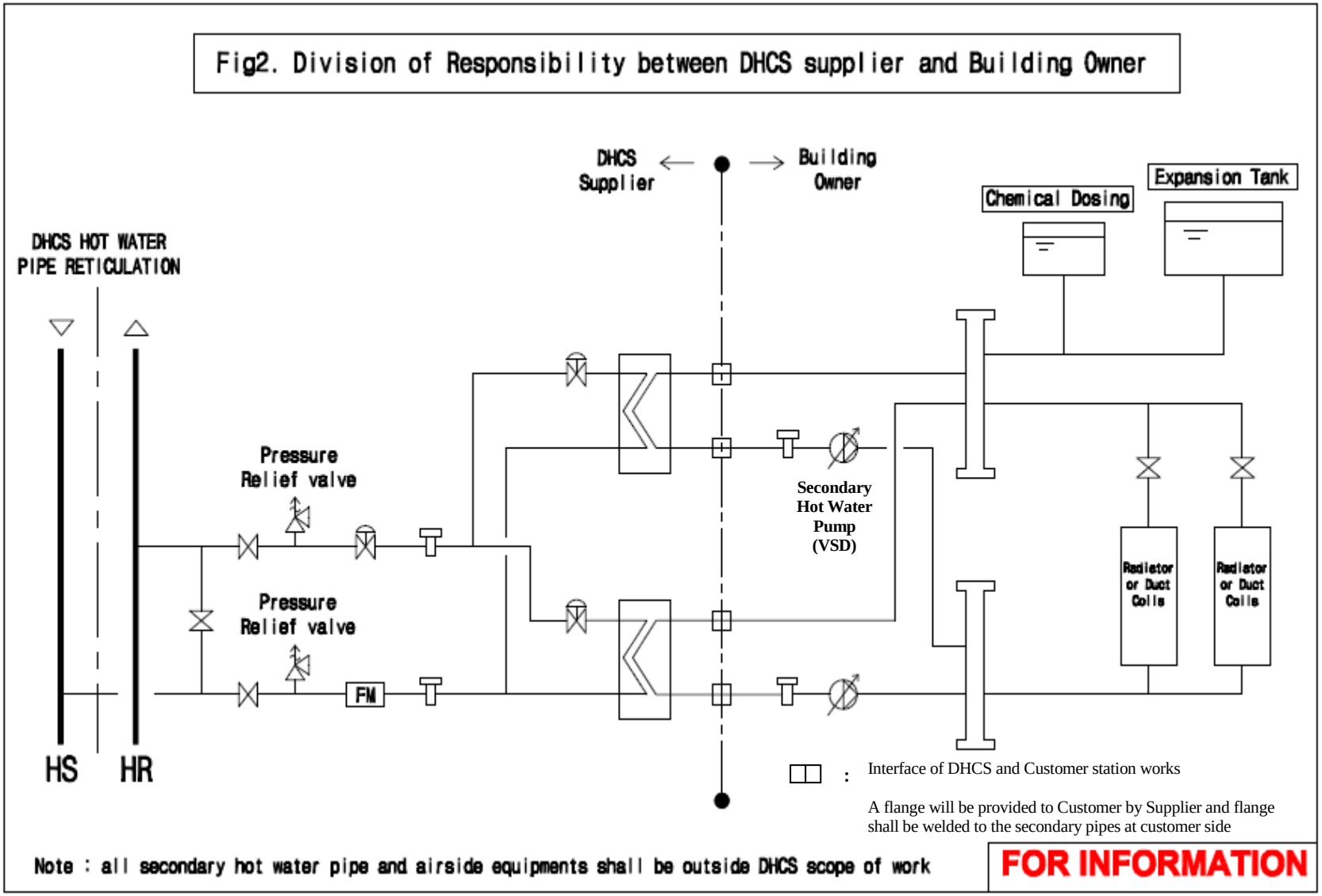
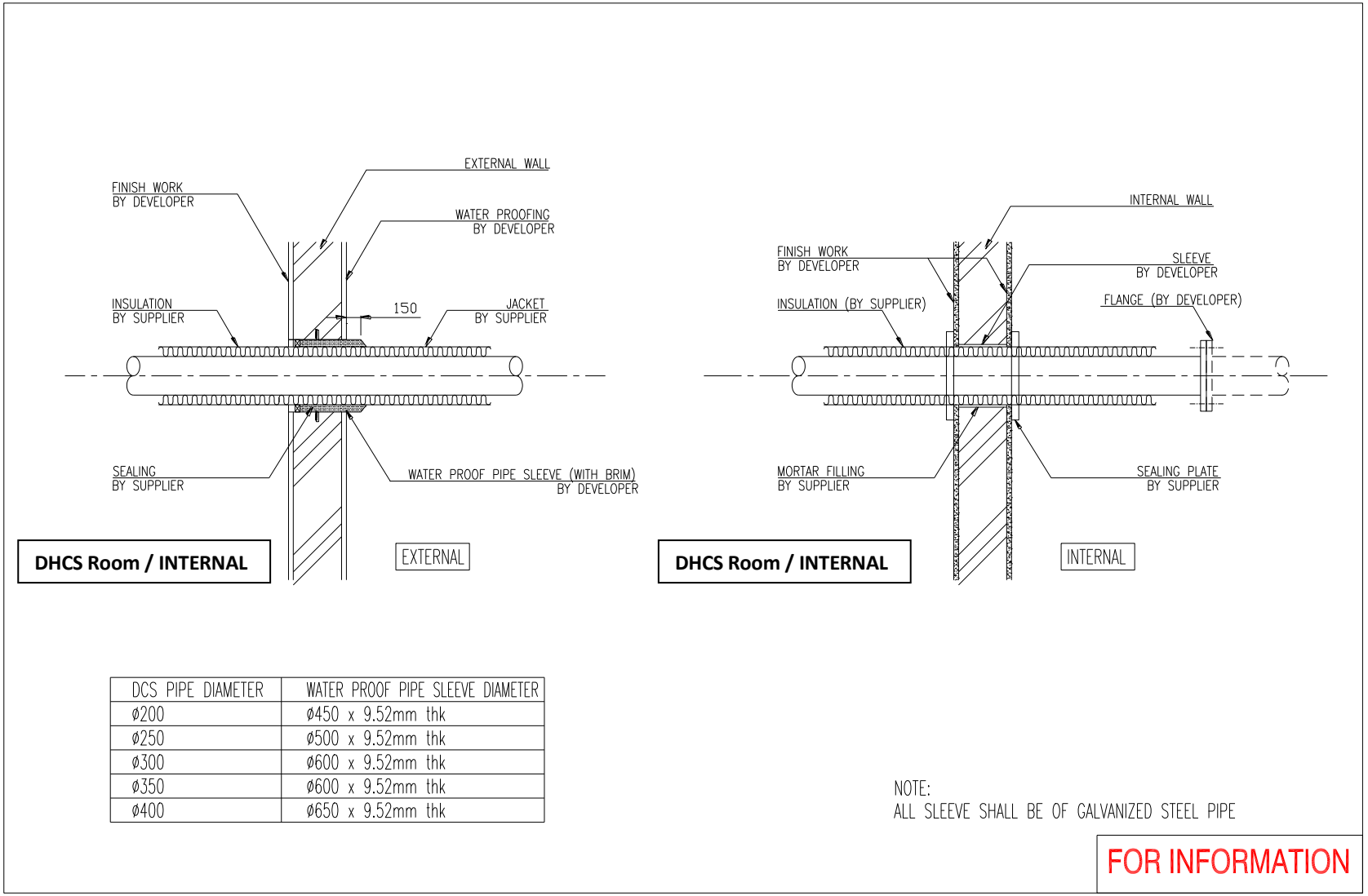


FIGURE 3. STANDARD DETAIL FOR DHCS PIPE PENETRATION



DCS PIPE DIAMETER	WATER PROOF PIPE SLEEVE DIAMETER
ø200	ø450 x 9.52mm thk
ø250	ø500 x 9.52mm thk
ø300	ø600 x 9.52mm thk
ø350	ø600 x 9.52mm thk
ø400	ø650 x 9.52mm thk

NOTE:
ALL SLEEVE SHALL BE OF GALVANIZED STEEL PIPE

FOR INFORMATION

FIGURE 4. Sample Electrical Wiring for DHCS customer station