LUSAIL DEVELOPMENT

PNEUMATIC AND TRADITIONAL WASTE COLLECTION SYSTEM DESIGN GUIDELINES FOR SUB-DEVELOPMENT

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1.0 INTRODUCTION

In order to achieve a sustainable development, environmentally sound waste management is an essential factor. Due to the large scale growth in real estate sector, emphasis on high rise developments has increased and waste management is very complicated. Also, with the ever increasing costs of managing waste and long term highly negative impacts on the environment, waste management has become a key factor in the planning of all new developments. Therefore, the need to bring about drastic reductions in waste generation is required and more importantly the need to implement the principles of avoidance, reuse, recycling and ultimately if required dispose.

Historically, highly mixed wastes were collected without any segregation or recovery of recyclables, thereby not only increasing the cost of collection and processing of these wastes but also losing valuable recyclables from the waste stream.

Waste management in high rise developments is fundamentally different from low rise or standalone houses and provision of recycling facilities differs majorly from the other types of developments. Therefore, to achieve a good recycling rate in the new high and medium rise developments, measures must be adopted which will enable the residents to segregate their waste at source itself.

2.0 DEFINITIONS

- Client – The master developer Lusail Real Estate Development Company (LREDC) or its appointed representatives.
- Contractor – The organizations or its appointed representatives, responsible for executions 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.
- Vendor – Any invited companies being eligible to submit the tender. The successful vendor will be the contractor or supplier.
- Supervising Consultant – Customer appointed representative.

- Recyclables- material such as plastic and glass bottles, aluminum cans, paper, cardboard, etc.
- PWC – Pneumatic Waste Collection
- DV – Discharge Valve
- AIV – Air Inlet Valve
- RCB – Remote Control Box for PWC system
- SV – Sectoring Valve

3.0 SOURCE SEGREGATION

Segregation of recyclable waste at source is not seriously practiced by households and establishments, who throw unsegregated waste directly into the municipal bins. At least 15% of the total waste can conveniently be segregated at source for recycling, which is being lost due to the absence of segregation of waste at source.

It is essential to save the recyclable waste material from going to the waste processing and disposal sites and using up landfill space. Profitable use of such materials could be generated by salvaging recyclables at source. This will save national resources whilst also saving the cost and efforts to dispose of such waste.

It is a must that all sub-development to ensure the waste is segregated at source and have infrastructure arrangement for the same in the developments.

Minimum 2 waste fractions must be implemented; i.e. Dry Recyclable Waste and Mixed General Waste.

Basic Color Code System for Waste Segregation

Type of Waste	Color Codes
Dry Recyclable Waste	Green
Mix General Waste	Black

Sub-developments are encouraged to undertake additional recyclable waste streams segregation to improve the efficiency of the recycling programs. To do this additional space is required in the storage point to house the required number of bins.

Sub-developments are encouraged to discuss your recyclable waste segregation options with Marafeq Qatar to ensure the feasibility of the same.

The following items are essential for the development of a sustainable waste management program within all the proposed developments. The key criterion is to plan and implement source segregation, which in turn will lead to numbers of environmental and financial benefits such as:

1. Cleaner recovery of recyclables and thus increased profits
2. Cleaner organic fractions, thereby producing better quality of compost
3. Reduction in costs of waste management
4. Greater awareness and reduction in waste generation rates
5. Compliance with National Development Strategy of Qatar

SS

4.0 Waste Management Plan

All the sub-developments are required to develop a Sustainable Waste Management Plan. Sustainable Waste Management Plan must include the following details but shall not be limited to:

a) Land use type;
b) Estimated Waste Streams and their amounts (in kgs);
c) Bin quantity, size and color;
d) On-Site Waste and Recycling equipment;
e) Waste Collection frequency;
f) Location and space allocated for Waste and Recycling bin;
g) Waste Collection point for Waste Trucks;
h) Scaled Waste Management Facilities Drawings;
i) Education & Signage.
j) Reporting System.

5.0 TYPES OF WASTE MANAGEMENT SYSTEM

Since Lusail City is being constructed based on very high international standards, wherein sustainability is emphasized and implemented, the waste collection is also designed to support such initiatives. The table below illustrates the different districts and the subsequent waste collection system to be implemented:

Type of Waste	Mixed Household (Apartments)	Offices / Hotels Mixed / Retails	Pedestrian	Bulky	Large Cartoon Boxes
Marina District	Pneumatic	Pneumatic	Pneumatic	Traditional	Traditional
Seef Lusail North (Waterfront Commercial)	Pneumatic	Pneumatic	Pneumatic	Traditional	Traditional
Seef Lusail – South (Waterfront Commercial)	Pneumatic	Pneumatic	Pneumatic	Traditional	Traditional
Commercial Boulevard	Pneumatic	Pneumatic	Pneumatic	Traditional	Traditional
All Other Areas	Traditional	Traditional	Traditional	Traditional	Traditional

There are basically two systems being designed for the purpose of waste collection, namely the Pneumatic Waste Collection (PWC) system and the traditional or conventional system. However, the developments being serviced by the PWC system will still require certain categories of waste to be collected periodically through the traditional system and this is addressed in the guidelines later in the report.

It is important to note that the PWC system for packages may not be operational without the completion of dedicated plant. The Customer shall be responsible for providing temporary measures to handle the Municipal Solid Waste (MSW) conventionally until the PWC system is available.

6.0 PNEUMATIC WASTE COLLECTION (PWC) SYSTEM

This new generation system addresses the problems of handling Municipal Solid Waste in any type of building in the following manner. Refer to **Appendix A** for illustration of components mentioned below.

1. Strategically located **Waste Loading Hoppers (A)** *with 3D volume control* to BS 1703; 2005 is provided on each floor.

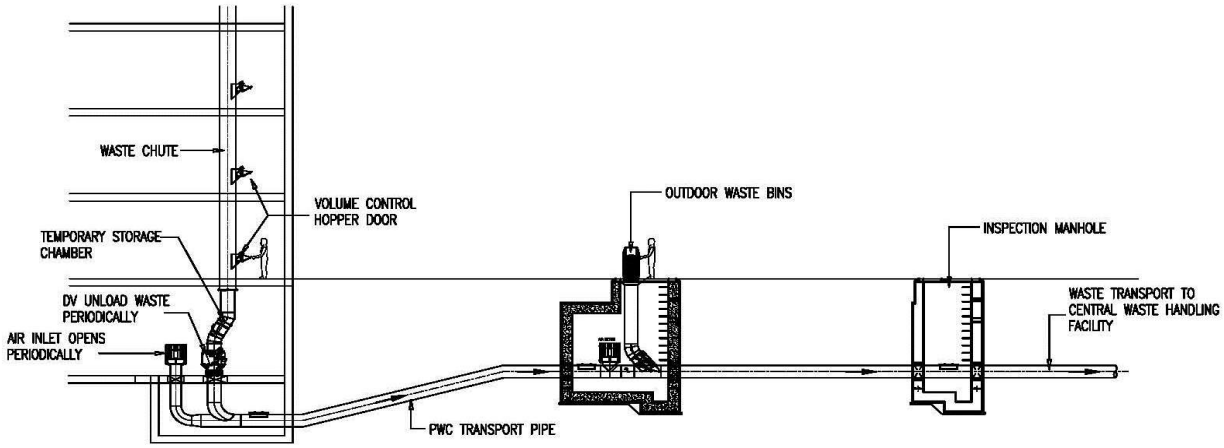
A volume control hopper restricts the entry of long items that should not be transported in the system.

2. These Waste Loading Hoppers are connected by a stainless-steel pipe that terminates at the base of the shaft where a **Discharge Valve (B)** temporarily holds the waste for a short period above it in a **Temporary Storage Chamber (C)**.

The picture shows a Discharge Valve (In Blue) with a Temporary Storage Chamber above it.

3. A network of **Transport Pipes (F)** from a **PWC Plant Room (M)** connects to **Air Inlet Valves (D)** that controls the flow of air in the pipe transport system.

4. At periodic intervals, the automated PWC system is started and it opens the respective Primary Air Inlet (through Air Intake Valve) to create a flow of air below a respective Discharge Valve which opens in sequence to vacuum the waste from the Temporary Storage Chamber through the transport pipes to the PWC Plant Room. Operating vacuum pressure of PWC system shall be around 350 mbar.



TYPICAL PNEUMATIC WASTE COLLECTION SYSTEM

5. The air that is used to transport waste is cleaned of all debris by a **Filtration System (G)** and the odor is removed by **De-odorizing System (H)** before the air is discharged to the atmosphere.

6. In the PWC Plant Room the waste is separated by a **Waste-Air Separator (J)** which unloads the waste into a stationary **Waste Compactor (K)** that pushes the waste material into transportable **Waste Container (L)**.

7. The containers are transported by the Municipality or the Appointed Waste Collector in standard flatbed hook lift trucks to the closest landfill or incinerator for disposal.

8. The frequency of transporting the waste from the Discharge Valves to the PWC Plant Room called the **Transport Cycle** is dependent on the volume of waste collected from each chute during the day.

9. The consolidation of waste from several buildings often means that the waste is never left for more than a few hours before it is on the way to a landfill or incinerator.

10. The larger material (bulky waste) that is unable to enter the Waste Loading Hoppers with volume control are handled manually – as this is traditionally recycled (old furniture, carton boxes, etc) it helps minimize landfill and incineration and aids in achieving environmental objectives.

11. A guideline for developments in terms of allocating space for bulk storage is available in BS5906:1980 which states:

a) Where communal waste storage accommodation or chutes and container chambers are installed, separate enclosed accommodation at ground level in an accessible position should be provided for the storage of large and bulky articles or salvageable materials or both, so that the local authority can make special collection arrangements. A minimum space of $10m^2$ is recommended or $0.3m^3$ per person with minimum headroom of not less than 2.3m.

b) Space that is otherwise utilized for larger Municipal Solid Waste (MSW) truck circulation and storage of the MSW on site is also freed for development. However, provisions for smaller truck access to remove bulky waste periodically are still required.

7.0 GENERAL SPECIFICATION OF PNEUMATIC WASTE COLLECTION SYSTEM

This section specifies the design, supply and installation of the Pneumatic Waste Collection (PWC) System. It briefly defines the function and specifications of the system to be delivered for a fully automatic means of collection and removal of municipal solid waste from each individual chute to the PWC Plant Room.

7.1 Types of Waste Generated

The following are various types of Municipal Solid Waste (MSW) generated in any building.

1. Mixed solid waste – practically all types of household kitchen waste, cafeteria and other F&B waste like bones, rice, cut vegetables, food scraps, disposable nappies, food wrapping, etc generated in either a residential or commercial building.

2. Mixed recyclables – small metal cans, plastic bottles, papers etc. generated in a residential mix-use and commercial building.

Both items 1 and 2 whether in a residential or commercial situation can be handled by the PWC system. Bulky waste is generally handled manually as they are too big to be handled safely by the PWC system – and are usually blocked out by the volumetric hoppers. Handling of bulky waste will be detailed in the traditional waste management section.

Note that the following types of waste are NOT permitted to be thrown into the chute and cannot be handled by the PWC system: -

a) Carton boxes folded or otherwise that are larger than 300mm in any direction

b) Glass more than 1% of the total waste mass handled from the building

c) Adhesives and flammable items

d) Construction debris or any other items that is heavy and dense like bricks, concrete lumps, motors, etc.

e) Liquids (soups, gravies, water, oils) that exceed 10% of the weight of waste bag

f) Biological, medical, hazardous and industrial waste

g) Dead animal carcasses.

h) Feces

3D volume control hopper doors are to be strictly enforced at each level to prevent users from disposing of unacceptable materials such as broken appliances, carpets, lumber, and large cardboard, which lead to system blockages. The hopper door must include an auto-locking system for operation, maintenance and safety purposes, along with status lights indicating Busy (red) and Ready (yellow), waste type selection button, and necessary signages (refer to Appendix K3).

Signages and guidelines with picture on the above-named limitations should be posted on all waste chute inlets to educate users. Training on these notices shall be conducted regularly with all facility management (FM) teams and tenants.

The FM team should develop a strategy to monitor and manage the requirement for segregation at source waste disposal by households (see recommendation under 9.0 Best Practice in Waste Management for Sub- Development).

It should also outline the corrective actions to be applied should tenants fail to follow system guides.

The Temporary Storage Chamber is designed to store 300 liters of waste before the level switch is triggered for the waste to be sucked into the transport pipes. The number of transport cycles per day for each chute is approximately 12 cycles. The system can also unload based on pre-set timer if the level switch is not activated. The maximum load per chute is therefore 3,600 liters/day. Larger waste volumes require an additional chute(s) and discharge valve(s).

It is important to note that the PWC system in Lusail development can handle 2 fractions of solid waste from the Customer. One fraction shall be mixed solid waste and the other fraction shall be recyclable waste. The typical details of PWC equipment room layout and section requirement are shown in **Appendix D** and **E.**

Appendix D1 is the detail for individual waste chute for the 2 waste fractions and the chute connected to the PWC system.

Appendix D2 is the detail for individual waste chute for the 2 waste fractions and the chute fit into the conventional waste bins.

Appendix E1 is the detail for a single common chute with a waste diverter or sorter below the chute. This detail also indicates the waste diverter connected to the PWC system.

Appendix E2 is the detail for a single common chute with a waste diverter or sorter below the chute. This detail also indicates the waste diverter connected to the convention waste bins.

Note that the waste diverter or sorter in **Appendix E1** and **E2** is typically supplied by the waste chute supplier as part of Customer's work. Both the hopper door in **Appendix E1** and **E2** requires a selector switch on the door exterior to facilitate the diversion of waste from the chute to the respective fraction compartments below.

It is recommended that individual chute (shown in **Appendix D1** and **D2** as **Option 1**) to be provided to handle dual fraction waste by the Customer. However, this will require more floor space in the typical floor. Caution should be taken in using waste diverter to divert waste (detailed in **Appendix E1** and **E2** as **Option 2**) from a single waste chute as any failure of waste diverter (due to poor maintenance) may cause waste blockage falling from the waste chute within the Customer's building. The developer should have a consistent service and maintenance in place for waste diverter if **Option 2** is selected due to floor space saving.

It is important to note that the garbage room details shown in **Appendix D** and **E** illustrate both options of waste chute connecting to PWC system and conventional waste bins. If the PWC system is not operational before the Customer building completion date, the Customer can install the pipe network up to the garbage room but with the PWC equipments to be installed at later stage.

7.2 System Provision

The PWC system within the Customer's building shall comprise of the following equipment, materials and accessories as part of Customer's scope of work:

a) Dia. 500mm vertical waste chutes (including waste diverter or sorter, if any) shall be normally provided by chute supplier at the location indicated in the Architectural plan for the disposal of waste from the upper floors. Each chute shall start from the floor above the discharge valve to the upper most floors and shall be provided with volume control hopper (waste inlet) on each floor. The chutes shall be compliant with the requirements of the Local Authorities such as but not limited to the Civil Defense, Health and Safety, the Municipality and such like. It is recommended to install top-of-chute exhaust fan to create negative pressure in the chute eliminating odors escaping from the chute into the waste disposal rooms.

b) Chute cleaning and fire sprinklers shall be provided as per local Authorities requirement. Activation signals from these provisions should be connected to the PWC system Remote Control Box to terminate the waste transport cycle of the respective chute. During waste unloading cycle, a signal from the PWC system should also be linked to the chute control panel to lock all waste inlet doors.

c) A general fire alarm from the sub-developer shall appear as an alarm in the plant room main panel and this will block any unloading cycle.

d) Off-set sections where applicable shall not exceed an angle of 30° from the pipeline. The offset piece shall be connected by flange joints for practical replacement.

e) The temporary storage section complete with waste level sensor will temporarily store the waste before it is sucked into the transport pipes during the transport cycle. There will be an access opening in the lower part of the temporary storage chamber for service and maintenance purposes. The waste level switch when activated will override the regular periodic timing of the transport cycle.

f) Air Intake Valve to allow fresh air intake during the transport cycle provides the air to push the waste during the transport cycle. The fresh air flow rate of 17,000 cubic meters per hour (CMH) during the transport mode requires the provision of air intake grilles to any room in which Air Inlet Valve is located. Note that this air flow into the room will only happen when the waste is under transport mode of about 2 minutes per cycle.

g) Discharge valves below the Temporary Storage Chamber open periodically to allow stored waste to enter the transport pipes. The Discharge Valves are constructed to

withstand the impact of waste falling from high levels.

h) Inspection piece or access cover (shown in **Appendix J**) shall be provided below the Discharge Valves for service and maintenance purposes. Adequate clear height of min 400mm above the pipe must be provided to access and inspect the internal of pipe. This access cover shall also be provided at each Y-tee branch off and 90 degrees bends. Access cover can only be installed on top of the pipe as side way installation will cause blockage of waste on the access cover.

There will be 500×380 mm internal cut–out observation holes on the pipe sections to serve as inspection openings. The gap between the cut-out piece and pipe shall be sealed with mastic material to maintain air tightness. The internal cut-out piece shall be held down by an adjustable threaded bolt with minimum size of M16 by the external top cover plate. The inspection openings will be covered by a rectangular box of 600x450mm with lip at the top and fully welded onto the pipe. The box shall be closed with top cover plate with bolt, nut and gasket and shall be airtight.

i) The waste transport pipe size shall be Carbon Steel with 500mm nominal diameter and minimum 6mm thick. As abrasion by waste flow will be more at bends, the thickness shall be at least 9mm thick. The pipe networks are generally welded so adequate space around the pipe should be considered for welding and weld inspection. Pipe shall be coated externally with 3LPE if installed underground and primed and painted with epoxy coating (RAL 6037) as per ISO 12944, C4-F condition if installed exposed or above ground.

Long radius bends 2000mm radius shall be provided to ensure the smooth flow of waste through the pipe network, except at the base of the discharge valve where a 750mm radius bend is used. A minimum distance of 5-meter straight pipe shall be provided if another next bend is required.

The maximum tee-off branch angle in any direction shall not exceed 30 degrees from the pipeline and the maximum allowable inclination upward or downward for the PWC SYSTEM pipeline shall be 15 degrees and 30 degrees respectively.

Inspection openings will be provided in the waste transport pipe network to allow for future maintenance. RC chamber with access manhole cover shall be constructed for each underground inspection opening. Typical details of pipe turning and tee-off are shown in Appendix B. Tagging / Labeling shall be provided for all PWC pipe, equipment and components as per Appendix K1 and K2.

j) A control system comprising a Central Control and Monitoring System, located in the PWC Plant Room, communicates with Remote Control Boxes (RCB) located in Discharge Valve rooms. The control system is computerized and is a programmable logic controller (PLC) based system. Please refer to **Appendix G** for typical communication cable installation detail.

k) Pipe sleeves for communication cable are provided together with the PWC pipe to each plot boundary tie-in point. Customers shall provide sleeve continuity from the tie-in point up to the building telecom room.

l) Adequate containment for compressed air and control/communication devices in a waterproof and dust-proof metal enclosure.

m) Each plot Customer should have an independent air compressor to supply compressed air distribution tubing network to all the pneumatic operated valves in the PWC system. The air compressor capacity ranges from 1.5 to 3.0 to provide minimum 6 bar pressure, air flow rate of 15L/h or as per PWC equipment manufacture's requirement. Please refer **Appendix F** for typical installation details.

n) Each Customer plot shall be provided with only one PWC connection adjacent to the plot boundary, approximately 1 meter inside the plot boundary line. The pipe depth shall be approximately 2.5 meters. As-built or design level and coordinates of the pipe tie-in point shall be obtained from LREDC/QD. Customers shall design the PWC network based on the as-built or design information of the PWC tie-in point. Any piling works for basement adjacent to the infrastructure PWC tie-in point should be protected by the Customer to ensure the existing infrastructure PWC pipe is not damaged.

   Note: The customer/building consultant is solely responsible for verifying information on the actual PWC pipe tie-in coordinates and level prior to the submission of the Design Drawings.

o) PWC equipment, such as Discharge Valve, Air Inlet Valve, Sectoring Valve and Remote-Control Box, shall be provided by the Customer and can be purchased from any reliable and reputable PWC system specialist available in Qatar. Recommended PWC system specialist are as follows

   i) Envac Qatar WLL
   ii) Stream Environment
   iii) Ross Roca
   iv) Urban Refuse Development (URD)

v) Or other aiming to qualify as PWC contractors should be able to deliver, manufacture or supply and install in accordance with the latest PWC Design Guidelines, Specifications, Additionally, they must comply with all the requirements detailed in the QUALIFICATION CRITERIA for the PNEUMATIC WASTE COLLECTION SYSTEM CONTRACTOR FOR SUBDEVELOPER IN LUSAIL CITY, subject to the review and approval of Marafeq Qatar.

vi) Customers are responsible for the design, supply, and installation of all equipment related to the PWC system, which includes the configuration of the PLC communication and Modbus for the input / output of RCB within the sub-developer.

p) General specifications for the above mentioned PWC equipment shall be as follows:

i) Discharge Valve (DV)

Item	Description	Specification
1	Body and finish	Carbon Steel,min. 6mm thick, Epoxy coated 200 microns, ISO12944, C3-F
2	Type of Joints	Flanges with gaskets to suit 500mm ND pipe min 6mm thick
3	Internal Closing Plate	Stainless Steel 316 min. 10mm thick
4	Drain system	50mm ND drainpipe to be connected to a separate drain point
5	Type of operation	Pneumatic
6	Operating Pressure	350mbar vacuum
7	Input and Output signal	Refer Appendix H

ii) Air Inlet Valve (AIV)

Item	Description	Specification
1	Body	a. Minimum 4mm thick stainless steel for outdoor pedestrian bins. b. Minimum 4mm thick carbon steel for plots.
2	Type of Joints	Flanges with gaskets to suit 500mm ND pipe
3	Type of operation	Pneumatic
4	Operating Pressure	350mbar vacuum
5	Others	Top screen protection for the low level installation
6	Input and Output	Refer Appendix H

iii) Sectoring Valve (SV)

Item	Description	Specification
1	Body and Finish	Carbon Steel min. 6mm thick, Epoxy coated 250 microns, ISO12944, C4 high durability coating
2	Type of Joints	Flanges with gaskets to suit 500mm ND pipe
3	Internal Closing Plate	Stainless Steel 316 min. 10mm thick
4	Type of operation	Pneumatic
5	Drain system	Drain provision for horizontal and vertical position
6	Operating Pressure	350mbar vacuum
7	Input and Output	Refer Appendix H

iv) Storage Section (SS)

Item	Description	Specification
1	Body and Finish	Stainless Steel 304, min. 4mm thickness c/w with watertight inspection opening door
2	Type of Joints	Flanges with gaskets to suit secondary air intake and vertical chute
3	Type of operation	Pneumatic
4	Operating Pressure	350mbar vacuum

i) Secondary Air Intake (SAI)

Item	Description	Specification
1	Body and Finish	Stainless Steel 304, min. 4mm thickness steel
2	Type of Joints	Flanges with gaskets to suit secondary air intake and vertical chute
3	Type of operation	Pneumatic
4	Operating Pressure	350mbar vacuum

All equipment shall be vacuum tested to withstand 35kPA by the manufacturer prior to the delivery.

The section of pipe that continues from the tie-in connection into the building should be fitted with flange isolation kits to ensure electrical isolation from the main buried pipe in the infrastructure. Furthermore, the downstream section of the pipe, located after the isolation joints, must be wrapped in 3LPE to prevent any contact with metallic elements of the structure.

7.3 Waste Collection Modes

The PWC system is designed to start automatically Transport Cycle automatically as follows:

a) Automatic start at pre-set times with collection of waste from all chutes ("Pre-timed Sequence" mode).

b) Automatic start when “high level” alarm is triggered by waste level switch from any of the waste storage section above a Discharge Valve (“High Level Sequence” mode).

c) Either one mentioned above will activate the transport cycle, whichever comes first.

7.4 General Work by Customer for PWC system

7.4.1 General Items

a) Adequate space for installation and future service of PWC network and equipment.

b) Provision of all floor and wall openings for the pipe’s penetration, including opening sleeves where necessary. Drawings indicating the size and location of the required wall openings shall be provided in the Detailed Design submission.

c) Design, supply, and construction of watertight RC chambers (shown in **Appendix J**) for underground pipe below the floor slab if or where required for inspection opening including watertight manhole covers.

d) Each PWC system pipe network within the Customer’s plot shall be fitted with sectoring valve for isolation during operation and maintenance. This valve will require appropriate drain pipe adjacent to its location for general cleaning and maintenance. A Gap of 600 to 1000mm on the pipe network for future installation of sectoring valve.

e) Transport pipes located in sensitive areas should be provided with acoustic treatment insulation to lessen sound during the waste transportation process. This will lead to an increase in the overall diameter of the pipe from 500mm ND to 600mm ND when standard rock wool insulation is utilized. In general, pipes placed in basement car parks do not need acoustic insulation, since any noise generated by the waste moving through the pipe is only present during transport.

7.4.2 Discharge Valve Room

a) Provision of all room civil and architectural works including MEP requirements for PWC system. The design of the room's structure and finishing is to be capable of withstanding negative pressure.

b) Room floors and walls finishes shall be of ceramic tiles or other finishes approved by the building consultant that facilitate **easy cleaning** and the floor shall be sloped towards the room floor drain and connected to the drain system. The drain should be provided with a protective cover to retain solid materials and traps should be accessible for cleaning, grease interception to be provided as per the system and local authority requirement.

c) Provision of all floor or wall penetrations, and made good after installation, including opening sleeves where necessary.

d) Provision of room ventilation, opening for air inlet valve and secondary air intake including louvers, ducts, silencers and fire dampers if necessary, including a separate drain point for the discharge valves, as the use of the room floor drain is not acceptable.

e) Provision of acoustic treatment to valves rooms where necessary. This includes all acoustic treatment to Architect's or acoustic specialist's details, including but not limited to the installation of acoustic lining to walls and ceiling and provision of acoustic doors.

f) Signal cable from the waste chute supplier control box for water spray and fire sprinkler to the PWC equipment Remote Control Box (RCB).

g) Requirement of each PWC equipment input and output to the PWC system main Central Control and Monitoring System in the plant room are tabulated in **Appendix H**. The Customer shall ensure that the equipment are provided with the necessary relay, switches, sensor and transmitter and appropriate signal cable to the control boxes.

h) Independent air compressor for the compressed air system to all PWC equipment.

i) Electrical isolation kits flange joints.

j) The PWC scope of works within the Customer shall be referred to in **Appendix C**

7.4.3 RCB Programming Logic Controller (PLC) and Communication specifications

a) RCB PLC programming shall comply with IEC 61131-3 standard for PLC programming languages and it shall be done in Ladder logic language

b) PLC shall be designed based on the provided I/O's list.

c) Provide 20% spare installed I/O points of each type

d) PLC for PWC system shall only be locally monitored and both remotely monitored and controlled from its respective PWC plant SCADA system.

e) RCB PLC cabinets /enclosures completely assembled with instruments and electrical controls mounted and wired to terminal strips for field connections.

f) RCB PLC shall be able to scan all inputs from PWC plant and chute, execute PLC programs and generate outputs to PWC plant and chute for the final control elements.

g) Monitor status of the system hardware and provide diagnostic information.

h) The PLC shall be provided with serial and Ethernet IP interface ports for communication.

i) RCB shall be provided with battery with minimum 2 hours back-up and standard nameplates for the cabinet/enclosure.

j) The system must support open network Modbus TCP/IP communication protocol to integrate with the infrastructure PWC Plant PLC/SCADA system.

k) As-built schematic and wiring diagrams for each cabinet/enclosure. Show color of wire, termination points, terminal numbers, cable, and wire numbers.

l) CAT 6 communication cable from the PWC RCB system to Sub-developer's Telecom Room will be laid provided that the distance between the RCB to Telecom room does not exceed 80 meters and the bandwidth requirement for end points are satisfied. For distance above 80 meters, fiber optic single mode redundant (2x2F) cable is recommended. Media convertor, patch chords and any accessories required for communication with the Lusail Control and Command Center (LCCC) and for termination with the Telecom Service Provider equipment in Telecom Room shall be installed.

BECKHOFF, MITSUBISHI, ALLEN BRADELY & SIEMENS make PLC shall only be used for PWC control system.

8.0 TRADITIONAL WASTE COLLECTION SYSTEM

This system involves the collection of waste from the various types of bins and containers, depending on the development and transported through different types of waste trucks. The guidelines for this type of waste collection system are given below and have been drafted taking into consideration the waste management strategy of Lusail to divert as much waste as possible from the landfills.

There are some developments which will be temporarily serviced through the traditional system till such time that the PWC system becomes operational. Care has been taken to ensure that there is a smooth transition from the temporary system to the pneumatic system.

The various guidelines mentioned below address the different types of developments and subsequent requirements for waste collection. All the drawings provided with this report are typical in nature and shall be used as the minimum required, it is left to the Customer to ensure that any changes to the design guidelines shall not divert from these minimum requirements and also the Customer shall ensure that future capacity and unforeseen events should be taken into consideration while constructing the garbage rooms and other associated utilities.

The Design Guidelines is a live document and will be periodically updated. The Customer shall be responsible for obtaining the latest version from Marafeq Qatar website.

Based on the various benefits of source segregation and keeping in mind types of developments, the following are recommended:

A. High Rise Developments

Option - 1: Individual chutes for at least 2 fractions of waste such as mixed solid and mix recyclables.

- The most basic system available for source segregation in multi-level projects is to use multiple chutes. A minimum of two sorts, mixed solid waste and mixed recyclables, is mandatory. Further chutes could be added if the source segregation is into three fractions or more. (Typical drawings are attached - **Appendix D1**)

Option- 2: Single chute with sorter/diverter (Typical drawings attached, **Appendix E2**)

- The Sorter/diverter shall use a single waste recycling chute (hereinafter “chute”) in a multi-level building to distribute materials pre-separated by tenants into a minimum of two separate containers, as determined by the building management. For example, one container will be designated for garbage; a second for mixed recyclables
- A tenant-activated, membrane keypad switch on a control panel incorporated above each chute intake door shall initiate appropriate container selection. As the correct container is accessed by the chute, the chute intake door is signaled available to the tenant who then disposes of the material. Remaining chute intake doors on other floors shall be disabled during the foregoing operation.

- This is a recommended system and all associated installations will be suggested by the various manufacturers.

The multiple-sort disposal system must be designed in such a way that permits the increase or decrease of waste streams, if so, required in the future. For larger items that do not fit in the multiple-sort disposal system provided on each floor, the Customer shall provide an internal storage room solely dedicated to this purpose to temporarily store white goods, bulky items and other waste materials that may be generated by occupants of the development. The internal storage room shall be clean, well-marked and conveniently accessible to residents of the development and to local municipal requirements and shall be designed and supervised by the building consultant. No waste materials shall be stored outside between collection days.

Garbage Room/Collection Areas– Standard specifications

- Garbage rooms should be located to support the efficient removal of containers, whether by human effort or vehicles, and to ensure their transportation to garbage collection vehicles.
- Unrestricted space shall be provided and provisions must be made for easy maneuvering of wheeled waste containers.
- Keeping waste storage areas clear of potential obstacles that would make it difficult to modify existing bin sizes
- The minimum height of the garbage room door shall not be less than 2.1 meters with minimum width of 1.8 meters (and to suit size of container) with doors opening outward or swinging out.
- Garbage rooms shall be provided with adequate lighting and ventilation or air conditioning for summer.
- Room floors and walls finishes shall be of ceramic tiles or other approved finishes that facilitate easy cleaning and the floor shall be sloped to a floor drain within the room connected to the house drain. The drain shall be provided with a protective cover to retain solid material. Floor drain traps should be readily accessible for cleaning. Water supply for cleaning, grease interception to be provided as per local authority and standard requirement.
- The minimum internal corridor width of the garbage room shall be 1.2 meters
- The room shall not have a floor to ceiling height of less than 2.6 meters

- There should be a space of 0.6 meters between the dumpster and door location
- Fire protection system (passive or active) to civil defense requirement.
- The garbage room should be able to accommodate all types of garbage containers
- The specifications for the various bins/containers recommended to be used for different developments are provided in this report.
- For a sorter chute system, the minimum area of the garbage room shall be 8m2
- The above items are just a recommended guide and the building consultant shall be responsible for providing the design of garbage room to suit all local authorities' requirements and applicable international standards.
- The typically recommended garbage room sizes are shown in **Appendix D2** and **E2.**

Chutes

- The material used for garbage chutes shall resist corrosion, prevent dampness, non-combustible and smooth inner surface
- Chute inner 500mm diameter (but not more than 600mm) and shall be dictated by the number of floors per development.
- Chute should be manufactured to comply with BS1703
- All chutes shall be provided with automatic foul air exhaust fan.
- Firefighting sprinklers should be provided on all floors for protection in case of fire which should operate automatically with spray heads on every floor.
- The ground garbage floor room should be provided with an automatic fire cut off door at the bottom of the chute. The fire door shall be operated by fusible link, which shall break in the event of a fire breaking out in the garbage room
- A sanitizing and disinfection unit shall be provided with each type of chute.
- The chutes should be designed such that they discharge the waste centrally over the waste container or discharge valves.
- The responsibility for selecting the type and make of waste chute and waste diverter lies solely with the sub-developer, who must ensure that the chosen options meet the requirements of the PWC and Traditional system in the development.

B. Mixed Use Developments

All the above-mentioned chute and garbage room specifications under 'High Rise Developments are valid in addition to providing separate collection areas for bulky material. The concept of waste compaction shall be implemented and sufficient storage space for commercial material such as cardboard shall be provided. Compaction significantly reduces the volume of waste generated and thereby reduces the waste transportation costs.

Therefore, it is highly recommended that the garbage room has sufficient space to accommodate a compactor skip/container, the choice of compactor is left to the prerogative of the sub developer.

The standard specification of the above mentioned skip is provided in the report

Note: For the Eurobin compactor (660 & 1100 liters) a minimum space of 1m is required at one side of the compactor for servicing requirements and a nominal 150 mm clearance is required at the other side.

C. Low Rise Developments

All developments with 3 floors (Ground + 2 floors) and above shall have a chute system installed. The recommended chute system is a single chute with a sorter/diverter or 2 individual chutes for wet and dry waste. The garbage room specifications will be similar to the ones mentioned above for high rise developments.

D. Standalone villas and townhouses

For all stand-alone villas and townhouses, the collection of waste will be done through the curb side collection and therefore there is no recommended garbage room. Each villa/townhouse will be provided with respective bins and these bins will be collected depending on the collection schedule.

Notes:

1. For multi-unit residential developments, it is recommended that a minimum of 10 m^2 of additional internal storage space be provided for the temporary storage of un-compacted garbage such as bulky items and large appliances.

2. The Customer must comply with all existing and future government regulations pertaining to waste reduction and waste audit programs and requirements in commercial, institutional, and multi-unit residential establishments.

3. For those developments with no segregation chutes, provision shall be made for interim storage of recyclables in an interim storage area (that also houses the garbage chute inlet hopper) on each floor. A caretaker takes recyclables from the interim storage area to a communal storage area, where recyclables may be stored in either MGBs or bulk bins.

4. All material used in the manufacture of the garbage chutes shall comply with BS 1703 and local and regional standards.

5. Provision of fire retardants and other fire control systems shall comply with the Qatari Civil Defense standards and other regional and international guidelines and standards.

6. The various systems provided as examples only and are not intended to constrain good, workable alternatives

9.0 Best Practice in Waste Management for Sub- Development

Waste Management requirements for sub-development in Lusail City outlined in this document, the following section discusses 'best practice' must be considered by all sub-developments.

I. Segregation of Waste

a) Use of Color-coded waste bags and bins - a more convenient method for separating waste **at the source** and ensuring loading of recyclable and non-recyclable waste type in the hopper door or waste inlet.

b) This approach helps reduce the mixing of different waste types from the building and facilitate easier sorting at the landfill.

II. Waste Baler

a) Waste Baler Units effectively compress and segregates recyclable waste, such as cardboard, plastics bottles and aluminum cans or tins.

b) A baler unit provides the benefit of optimizing waste storage spaces, minimizing the need for frequent collection and facilitating improved housekeeping.

III. Refrigerated Rooms

a) Refrigerated rooms minimize odors, vectors and vermin at the storage point.

b) Options for refrigeration rooms include:

i. Air conditioning the sealed storage point.

ii. Refrigeration should be considered where general waste collection frequency is less than twice per week and/or a high level of organic waste will be generated (Restaurants, F&B and Supermarkets etc.).

IV. Education and signage

Continuous education and proper signages are essential to ensure that individuals utilize the facilities in the manner the system was originally designed for.

Marafeq Qatar recommends the use of signages at all disposal and storage points to underline the importance of recycling and to clarify the appropriate waste types for each facility or bin.

The educational content or signages should include:

a) Labelling all bins or waste disposal points.

b) Guidelines for the proper segregation of general waste, recycling materials, and other waste type from the source.

c) Identification of potential hazards/dangers associated with using waste equipment.

d) The operation signage allows users to conveniently choose the type of waste that will be disposed of through the hopper door or waste inlet.

e) Signage that includes detailed information on waste management in the development.

Bin Types and Dimensions

The below are few standard bins type and the sub-development must use these types of bins at their development.

Dimensions are provided for reference and ensure the sub-development is contacted relative supplier/manufacture.

Capacity of Bins	Length (mm)	Width (mm)	Height (mm)
240 Liters	740	580	1100
1100 Liters (Flat Lid Type)	1240	1070	1330
20 CBM Roll-On Roll-Off with lid	6405	2400	2130
Portable Compactors	6405	2400	2130

240 Ltrs Bin

1100 Ltrs Bin

20 CBM Ro-Ro

16 CBM
Portable Compactor

Note:

Different manufacturers produce skips of varying dimensions. The above mentioned are typical and as a guide and reference only for the Customers.

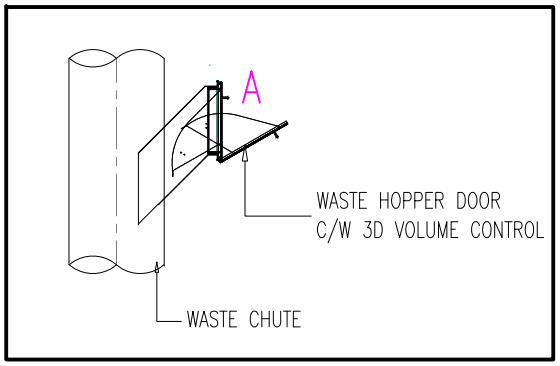
10.0 CODES & STANDARDS

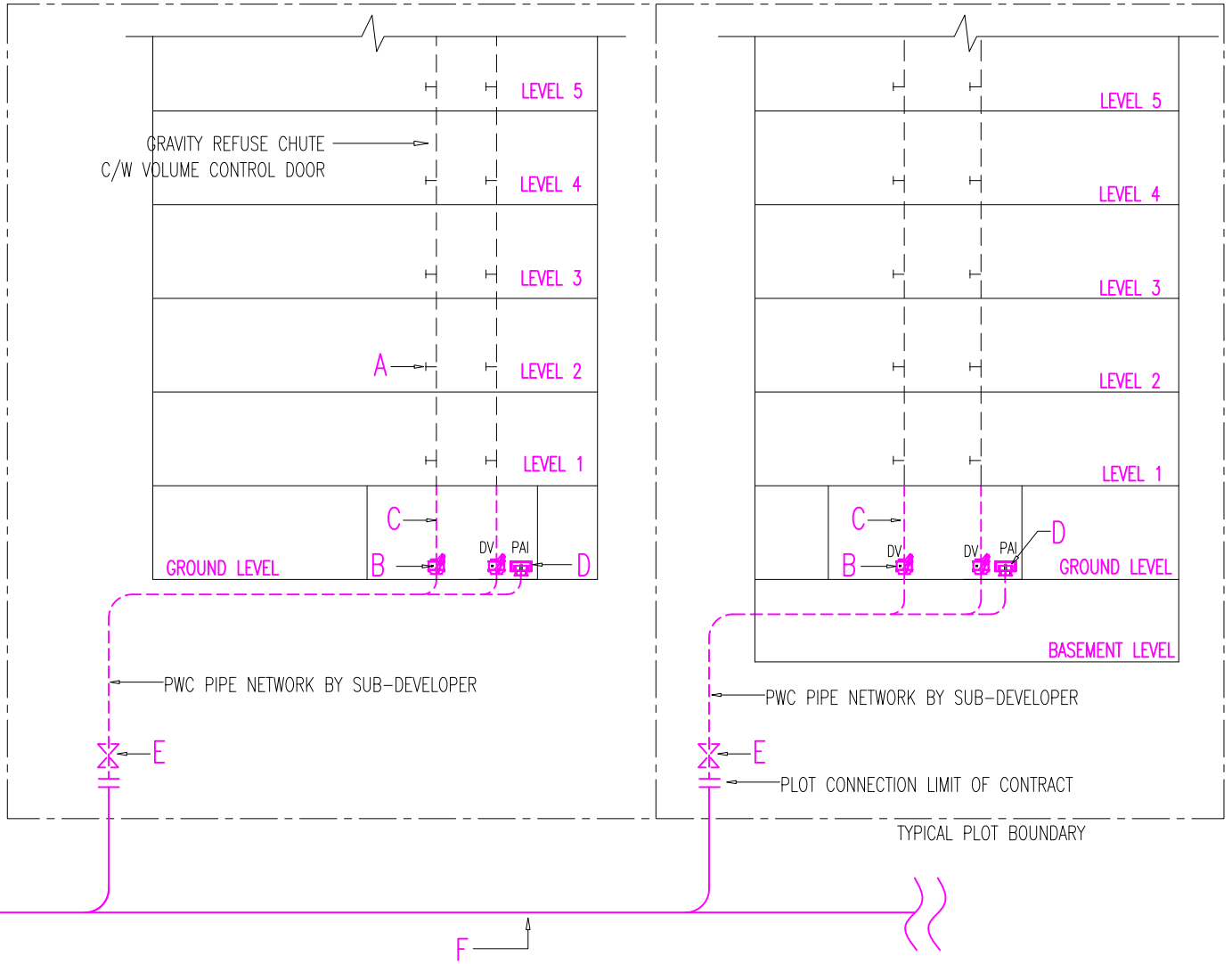
The materials and equipment that are supplied and installed must conform, at a minimum, to the requirements established by local standards and the international codes listed below. If no edition date is specified for a code or standard, the latest edition that is in force at the time of the contract award and implementation shall be considered applicable.

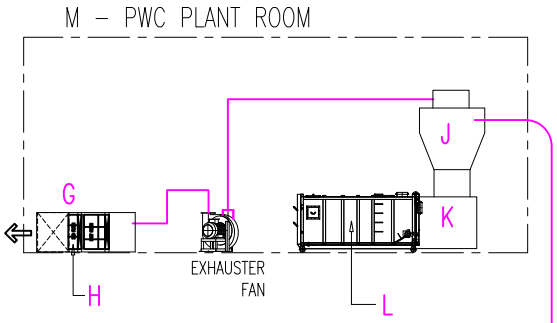
QCS	Qatar Construction Specifications
Kahramaa	Qatar General Electricity & Water Corporation
QCDD	Qatar Civil Defence Department
EN	European Standards
NFPA	National Fire Protection Association
ASME	American Society of Mechanical Engineers
BSI	British Standards Institute
CIBSE	Chartered Institution of Building Services Engineers
ASTM	American Society for Testing Materials
ISO	International Organization for Standardization

11.0 APPENDICES

A	Typical PWC Schematic Diagram
B	Pipe turning and tee-off plan details
C	PWC Scope of Work within Customer
D1	PWC DV room detail Option 1, 2 fractions with 2 chutes
D2	Garbage room detail Option 1, 2 fractions with 2 chutes
E1	PWC DV room detail Option 2, 2 fractions with 1 chute
E2	Garbage room detail Option 2, 2 fractions with 1 chute
F	Compressed Air System typical detail
G	Communication System typical detail
H	PWC system main Input / Output List
I	Minimum Deliverables for sub-developer RCB
J	Inspection opening and RC Chamber Typical Details
K1	Sub-developer PWC system Tagging Details-1
K2	Sub-developer PWC system Tagging Details-2
K3	Standard PWC Hopper Door Signage







A – HOOPER DOOR WITH VOLUME CONTROL
B – DISCHARGE VALVE (DV)
C – WASTE TEMPORARY STORAGE
D – PRIMARY AIR INLET (AIR INLET VALVE)
E – SECTORING VALVE WITH RC CHAMBER
F – PWC TRANSPORT PIPE (INFRASTRUCTURE)
G – FILTER HOUSE
H – DEO FILTER
J – WASTE SEPERATOR
K – WASTE COMPACTOR
L – WASTE CONTAINER
M – PWC PLANT ROOM

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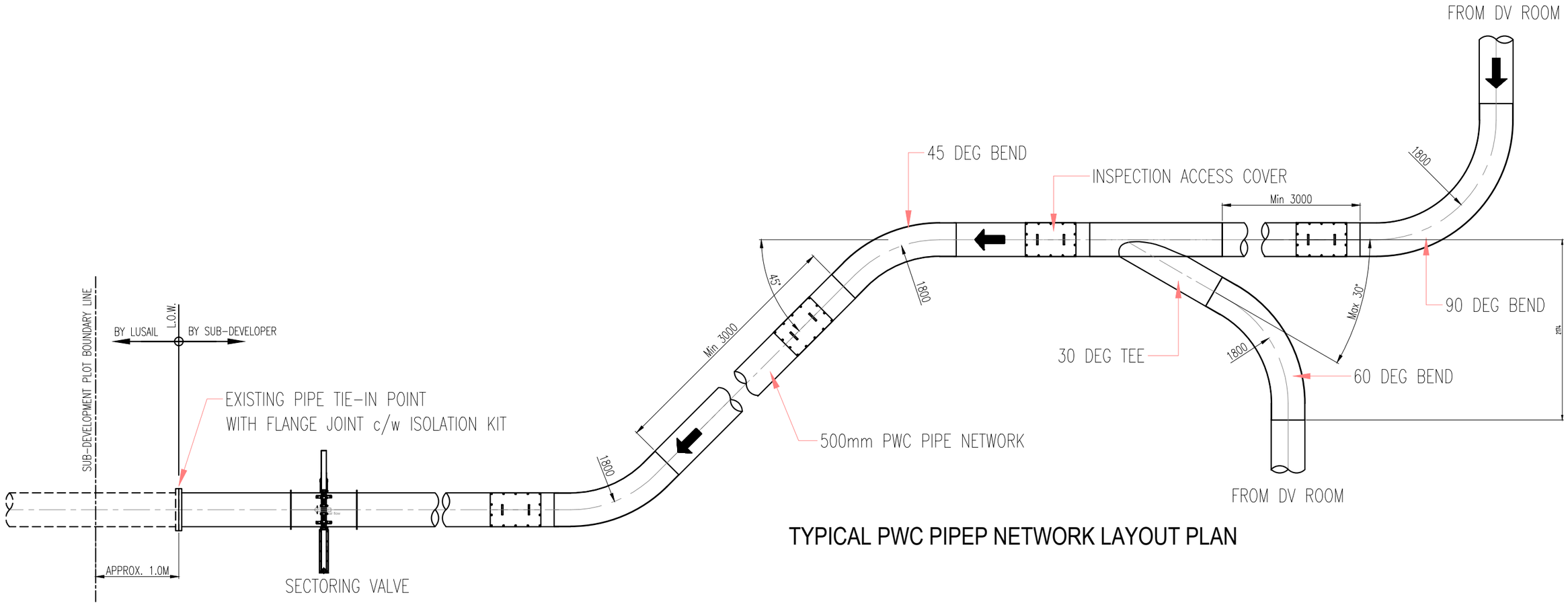
TYPICAL PWC SCHEMATIC DIAGRAM

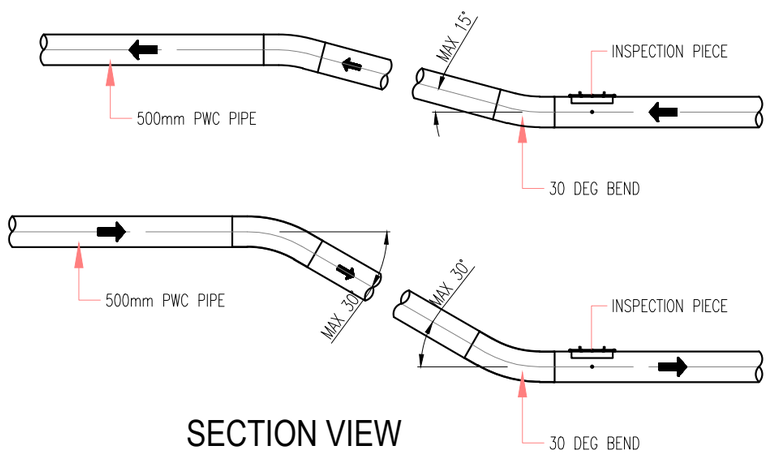
NOT TO SCALE

APPENDIX A

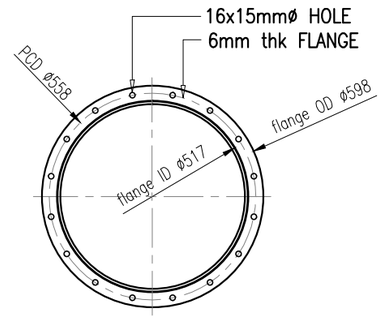


TYPICAL PWC PIPEP NETWORK LAYOUT PLAN

NOTE: SUPPORT TO BE PROVIDED @ EVERY CHANGE IN PIPE DIRECTION.



SECTION VIEW



TYPICAL FLANGE FOR PWC EQUIPMENTS

NOTE: ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING

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PIPE TURNING AND TEE-OFF DETAILS	
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APPENDIX B

Appendix C

LUSAIL CITY DEVELOPMENT -Sub-developer PWC System Contract Responsibility Matrix

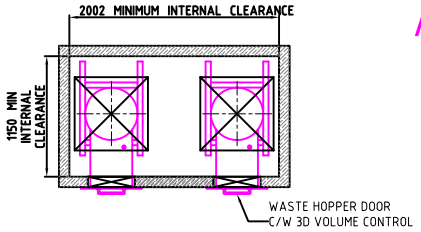
Item No.	Description	Requirement	Action By		
			Customer/ sub-developer	Marafeq Qatar	QD-LCO
1	Detailed Design Drawings submittal for PWC system.	review and approval by MQ	√	√	
2	Materials submittal for PWC system, including the 3D hopper door.		√	√	
3	Method Statement submittal for the installation of Tie-in connection, undeground & exposed pipe, equipment & components within the sub-developer plot.		√	√	
4	Ministry of Municipality Design Control (DC1) online system submission for PWC.	review and approval by MQ, uploaded drawings and documents must be approved and stamped by MQ.	√	√	
5	Builder's Work ie; floor and wall openings, access door, floor and wall finishes, etc.	in compliance with the Local Authority requirements, latest PWC Design Guidelines and Specifications	√		
6	MEP requirements ie; AIV/SAI air intake grille, HVAC, equipment drainage system, lighting, power and water supply, etc.		√		
7	Tie-in connection of underground PWC pipe from the sub-developer to the existing infrastructure pipe.	- the methodology/procedure for tie in connection for live system should be strictly followed and must be coordinated with QD-LCO and relevant stakeholders.	√		√
8	Extension of the existing 4 nos. of pipe sleeves/duct from infra to inside building telecom room.	customer to verify and confirm the material technical data sheet and test reports during delivery, and to ensure that the installation is conducted in accordance with the latest Design Guidelines, Specifications, and the Marafeq approved submittals.	√		
9	Supply and Installation of exposed PWC pipe network within the sub-developer plot.		√		
10	Supply and Installation of all PWC equipment and components.		√		
11	Supply and Installation of complete communication cable, inlcuding the provision for the Ooredoo connection at the telecom room.		√		
12	Supply and Installation of complete compressed air system.		√		
13	Air leak testing, NDT (welding joint) and CCTV pipe survey of PWC pipe network within the sub-developer plot.	must be performed by a third party specialist with calibrated equipment	√		
14	Typical garbage room, hopper door and operation signages, (refer to appendix K1, K2 and K3 for details).	must be weatherproof and resistant to fading (A3 min. size)	√		
15	Tagging/Labeling of the PWC system equipment, components, sub-components, compressed air and communication cable.	use ferulle tube for tagging	√		
16	Internal test report of the system, prior to the inspection.	to be included on the INR documents in 2 sets of hardcopies	√		
17	Inspection of tie-in connection and underground pipe installation prior to backfilling.	sub-developer must apply Inspection Request (INR) filed form with stamped and signed by the buildig consultant, prior to the inspection.	√	√	
18	Inspection of Final Mechanical Installation, including Dry-run test/Pre-T&C prior to the integration of subdeveloper to the PWC plant.		√	√	
19	Hand-over process, the PWC contractor must provide the customer or owner with as-built drawings, spare parts, waste management plan and other pertinent documents, which should include a soft copy of the PLC software.	PLC software must be open/non-password protected.	√		
20	Integration of sub-developer to the PWC plant ie; Ooredoo application, Final Testing & Commissioning, Configuration of mod-bus register, Operation, etc.	This process initiates solely after MQ has granted the final approved INR to the customer/sub-developer.	√		√

Notes:

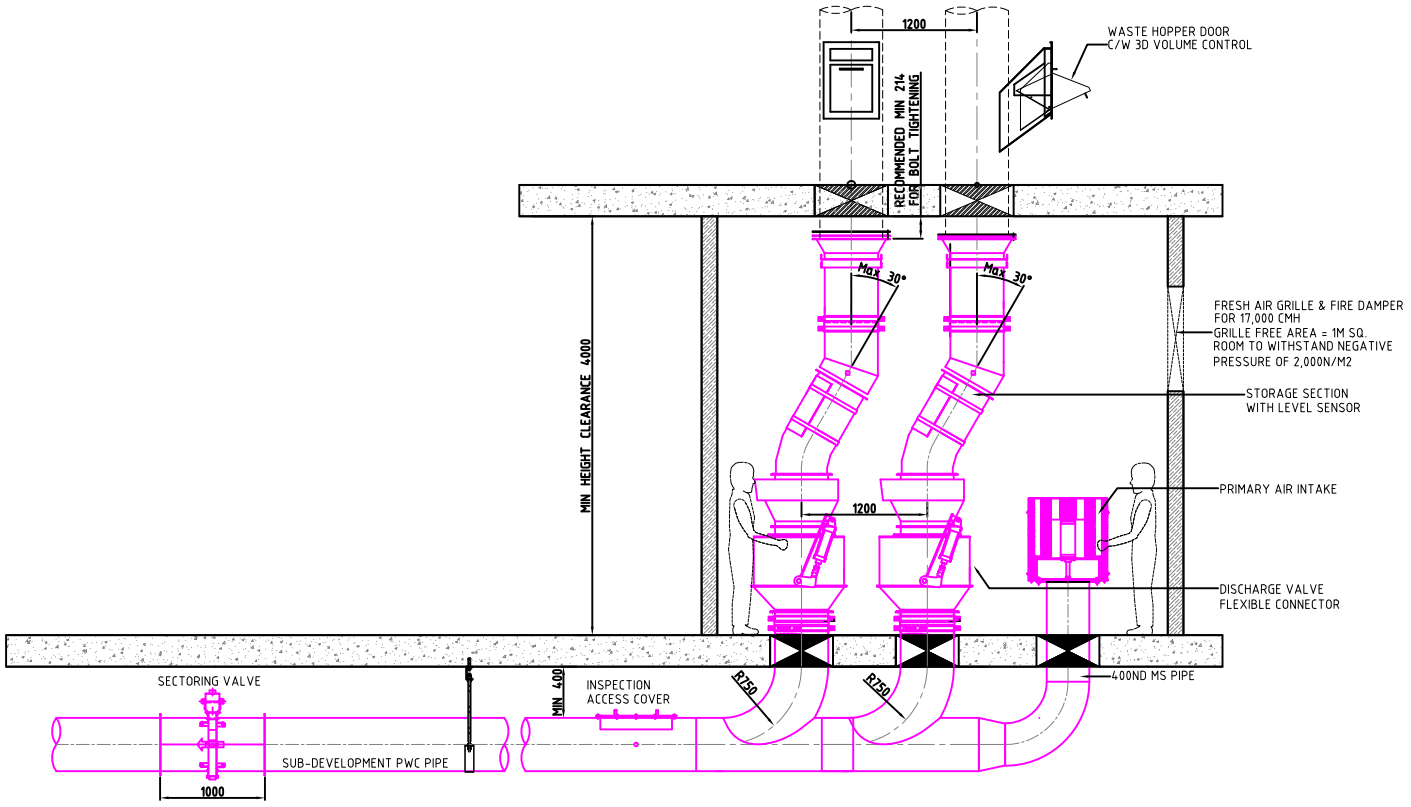
1. The above table indicate the typical scope of work within the plot sub-development.
2. The sub-developer must ensure that the installation and materials complies with the MQ approved submittals and the latest PWC system design guidelines and specifications.
3. This a live document and may include future changes and additions, readers should feel free to suggest items that are necessary for the improvement and completion of the PWC system.

APPENDIX D1

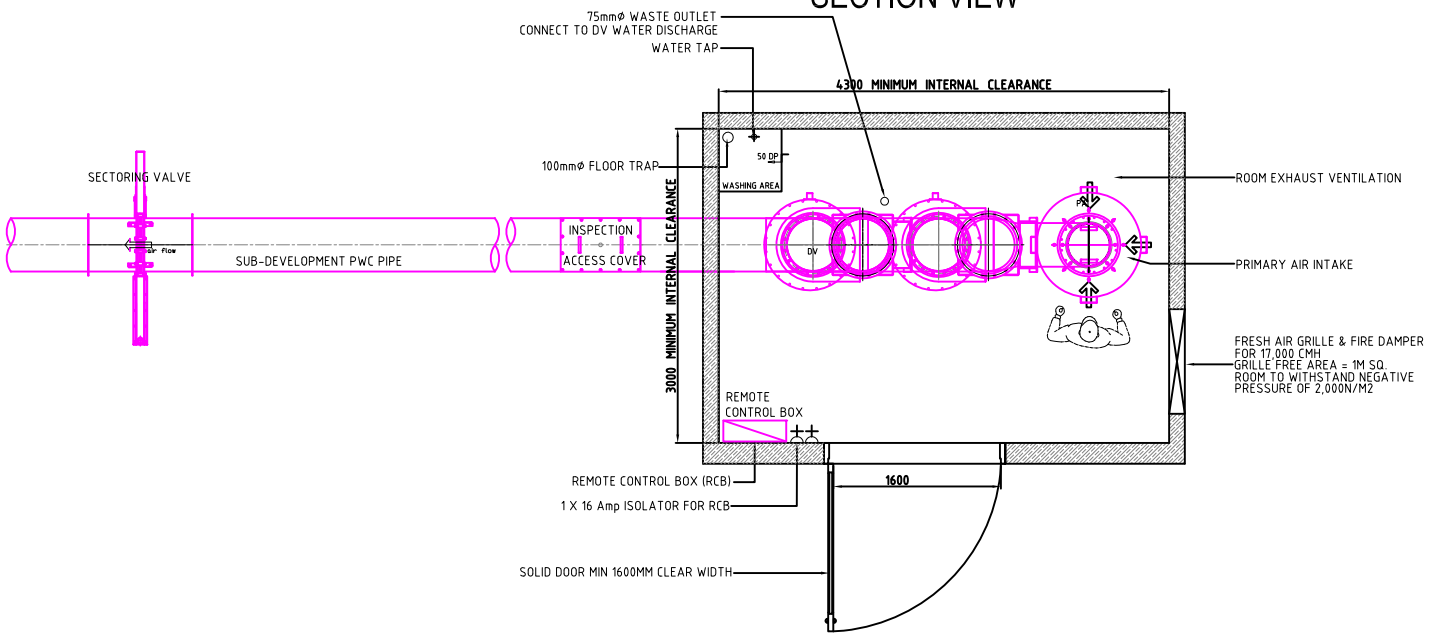
1. THE PROPOSED ROOM DIMENSIONS ARE INDICATED FOR GENERAL GUIDANCE.
2. THE CUSTOMER SHALL ENSURE THAT ADEQUATE CLEAR SPACES ARE PROVIDED FOR GENERAL ROUTINE MAINTENANCE.
3. ACHITECURAL REQUIREMENT SHALL BE CONFIRMED WITH THE CHUTE SUPPLIER.
4. REMOTE CONTROL BOX FOR PWC SYSTEM ARE GENERALLY LOCATED WITH THE DV ROOM.
5. SECTORING VALVE AND INSPECTION ACCESS COVER SHALL BE INSTALLED IN RC CHAMBER WITH ACCESS MANHOLE FOR UNDERGROUND PIPE INSTALLATION
6. ALL PWC SYSTEM CONTROL SIGNAL CABLE SHALL BE CONNECTED TO THE OOREDOO'S TELECOM ROOM FIBER TERMINATION BOX.
7. CHUTE CLEANING AND FIRE SPRINKLER ACTIVATION SIGNAL SHALL BE LINKED TO PWC SYSTEM RCB TO ISOLATE PWC SYSTEM WASTE UNLOADING CYCLE.
8. DV ROOM SHOULD NOT BE SHARED WITH BULKY WASTE STORAGE.



WASTE CHUTE LAYOUT PLAN



SECTION VIEW



DV ROOM LAYOUT PLAN

NOTE: ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING

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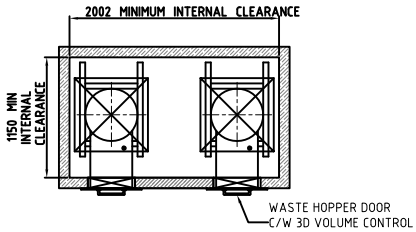
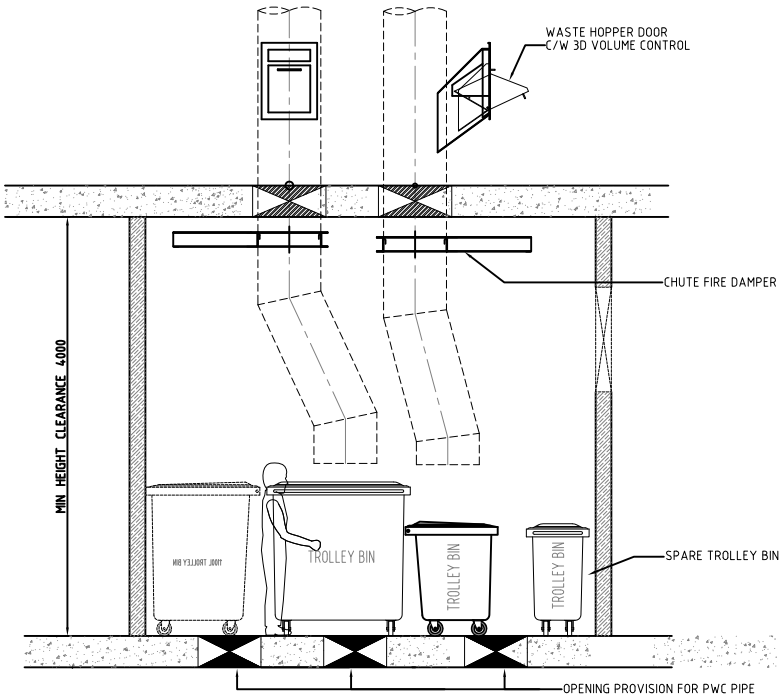
PWC DV ROOM DETAIL OPTION 1
2 FRACTION WITH 2 CHUTES

NOT TO SCALE

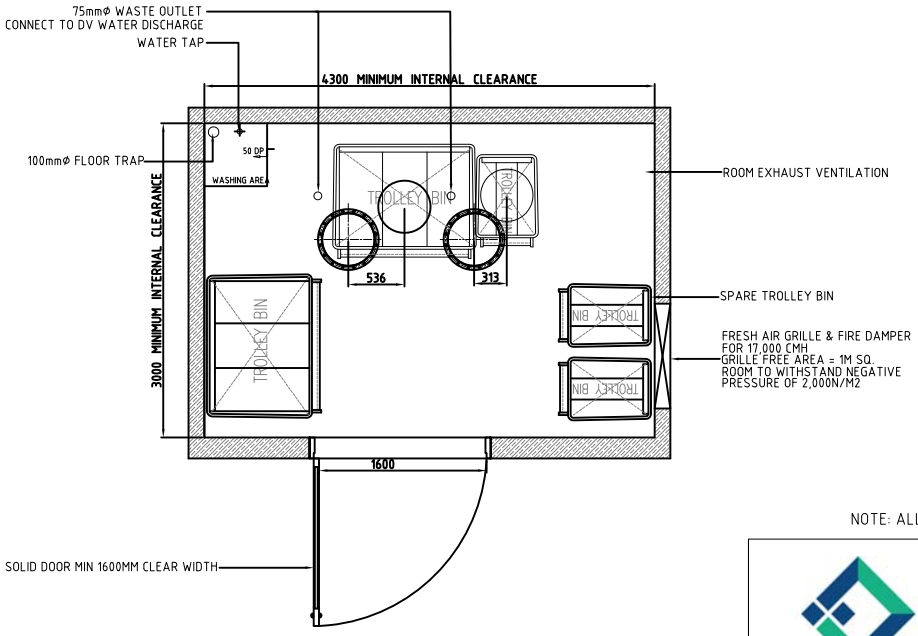


WASTE CHUTE LAYOUT PLAN

1. THE PROPOSED ROOM DIMENSIONS ARE INDICATED FOR GENERAL GUIDANCE.
2. THE CUSTOMER SHALL ENSURE THAT ADEQUATE CLEAR SPACES ARE PROVIDED FOR GENERAL ROUTINE MAINTENANCE.
3. ACHITECURAL REQUIREMENT SHALL BE CONFIRMED WITH THE CHUTE SUPPLIER.



SECTION VIEW

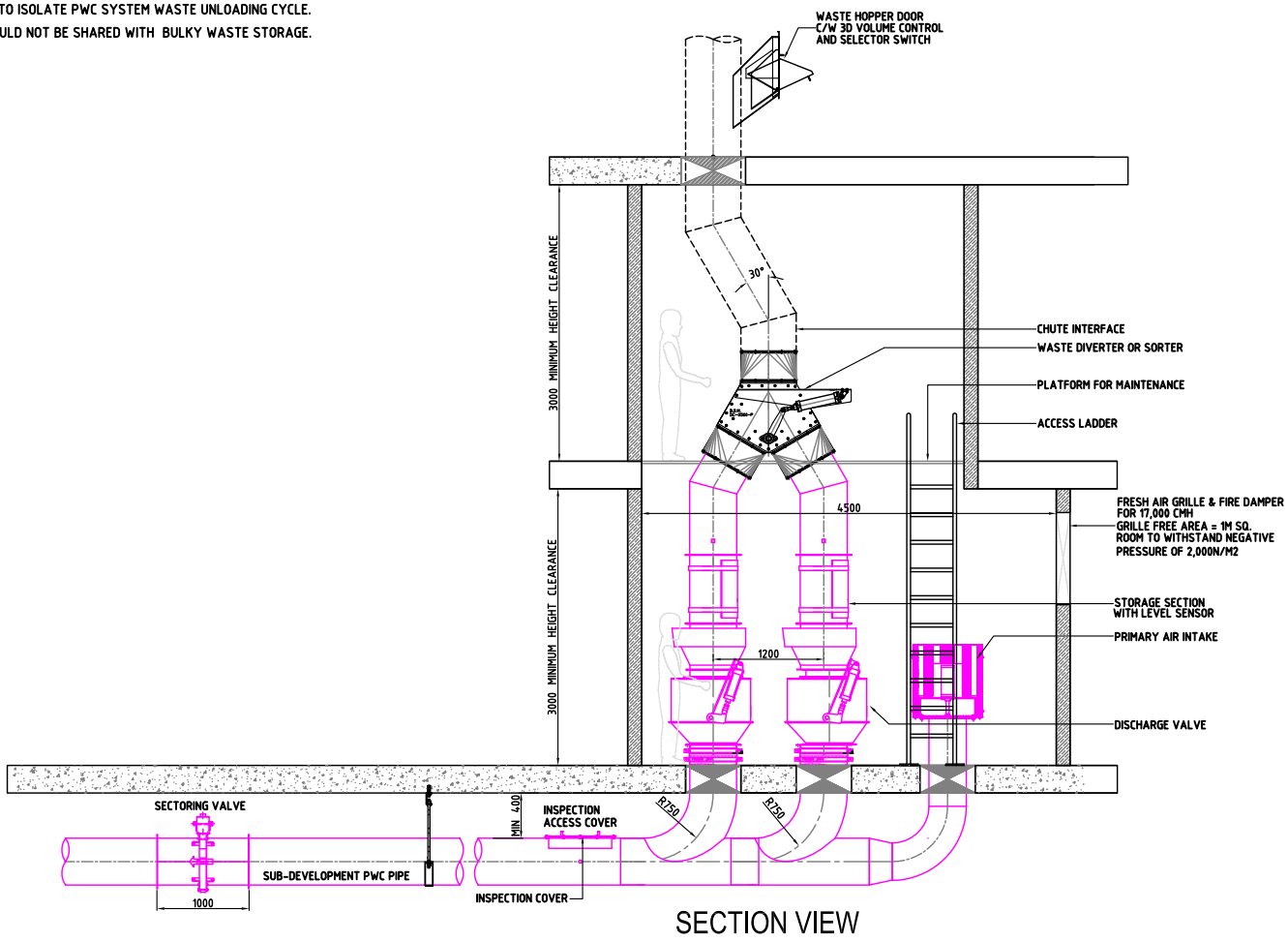


DV ROOM LAYOUT PLAN

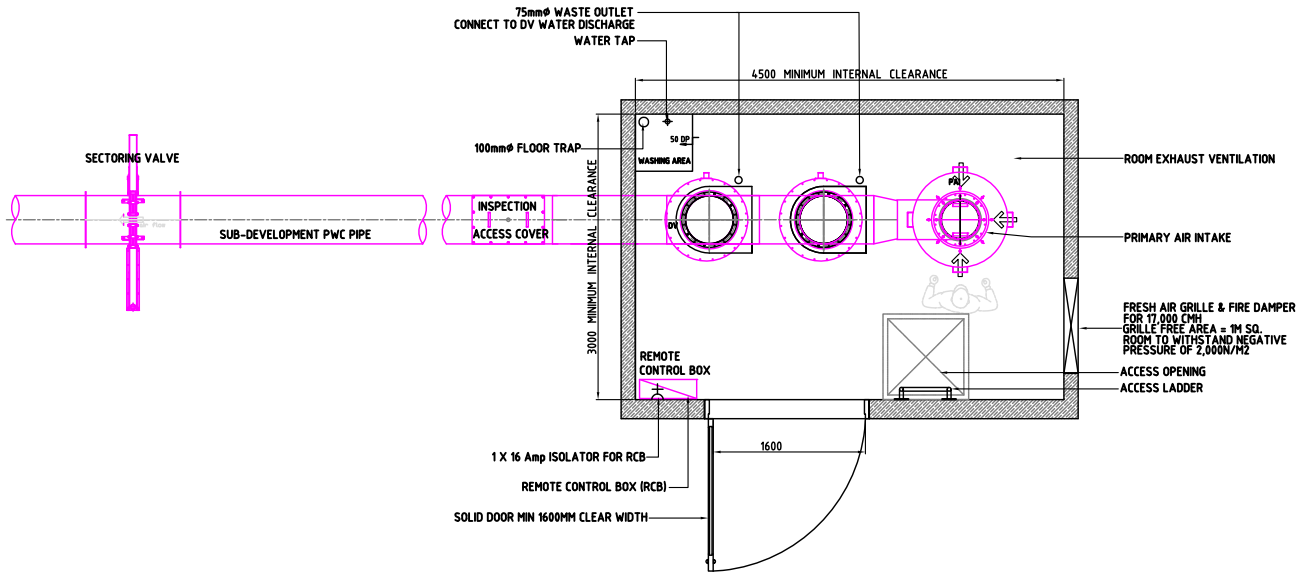
NOTE: ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING

Marafeq Qatar	ISSUED FOR INFORMATION
	GARBAGE ROOM DETAIL OPTION 1 2 FRACTION WITH 2 CHUTES
	NOT TO SCALE

1. THE PROPOSED ROOM DIMENSIONS ARE INDICATED FOR GENERAL GUIDANCE.
2. THE CUSTOMER SHALL ENSURE THAT ADEQUATE CLEAR SPACES ARE PROVIDED FOR GENERAL ROUTINE MAINTENANCE.
3. ACHITECURAL REQUIREMENT SHALL BE CONFIRMED WITH THE CHUTE SUPPLIER.
4. REMOTE CONTROL BOX FOR PWC SYSTEM ARE GENERALLY LOCATED WITH THE DV ROOM.
5. SECTORING VALVE AND INSPECTION ACCESS COVER SHALL BE INSTALLED IN RC CHAMBER WITH ACCESS MANHOLE FOR UNDERGROUND PIPE INSTALLATION
6. ALL PWC SYSTEM CONTROL SIGNAL CABLE SHALL BE CONNECTED TO THE OOREDOO'S TELECOM ROOM FIBER TERMINATION BOX.
7. CHUTE CLEANING AND FIRE SPRINKLER ACTIVATION SIGNAL SHALL BE LINKED TO PWC SYSTEM RCB TO ISOLATE PWC SYSTEM WASTE UNLOADING CYCLE.
8. DV ROOM SHOULD NOT BE SHARED WITH BULKY WASTE STORAGE.



SECTION VIEW

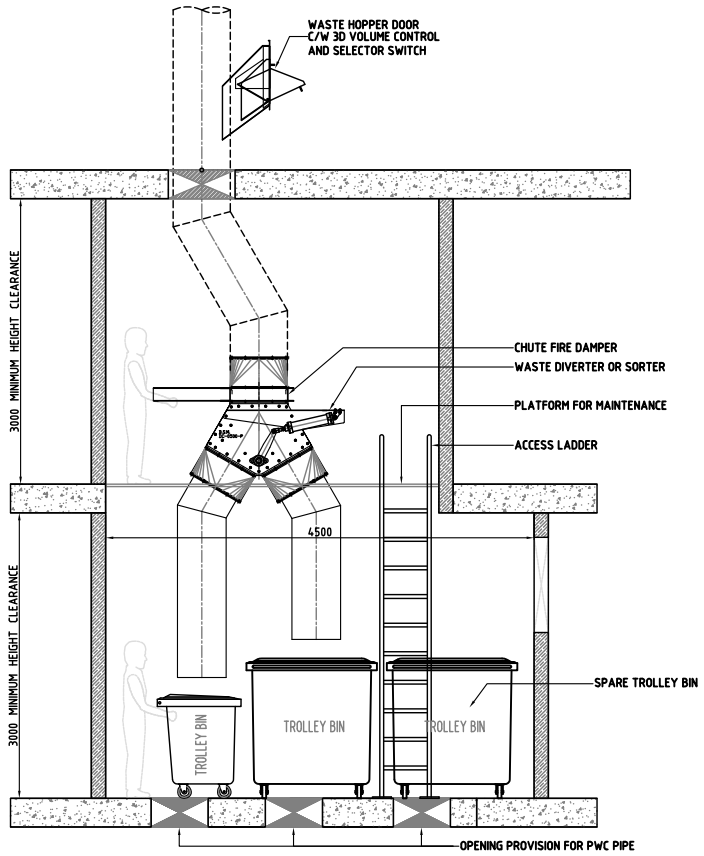


DV ROOM LAYOUT PLAN

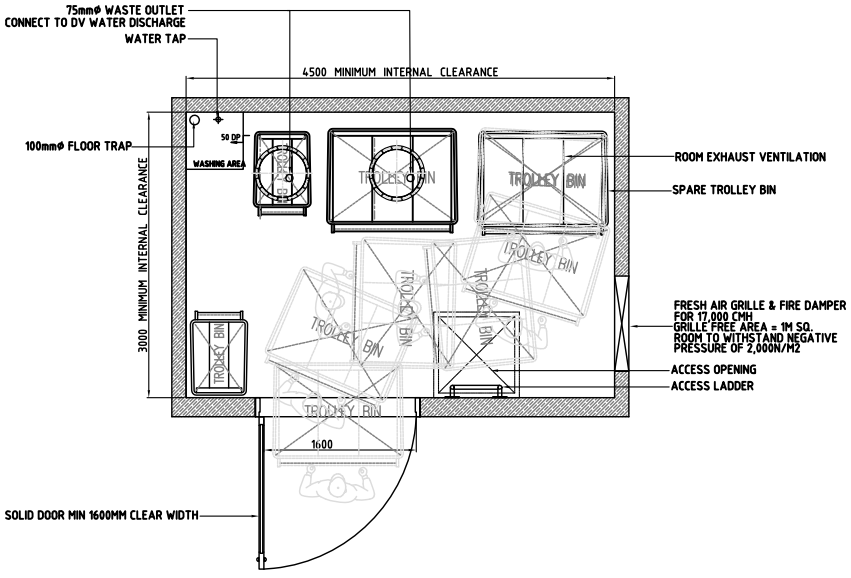
NOTE: ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING

Marafeq Qatar	ISSUED FOR INFORMATION
	PWC DV ROOM DETAIL OPTION 2 2 FRACTION WITH 1 CHUTE
	NOT TO SCALE

1. THE PROPOSED ROOM DIMENSIONS ARE INDICATED FOR GENERAL GUIDANCE.
2. THE CUSTOMER SHALL ENSURE THAT ADEQUATE CLEAR SPACES ARE PROVIDED FOR GENERAL ROUTINE MAINTENANCE.



SECTION VIEW



DV ROOM LAYOUT PLAN

NOTE: ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING

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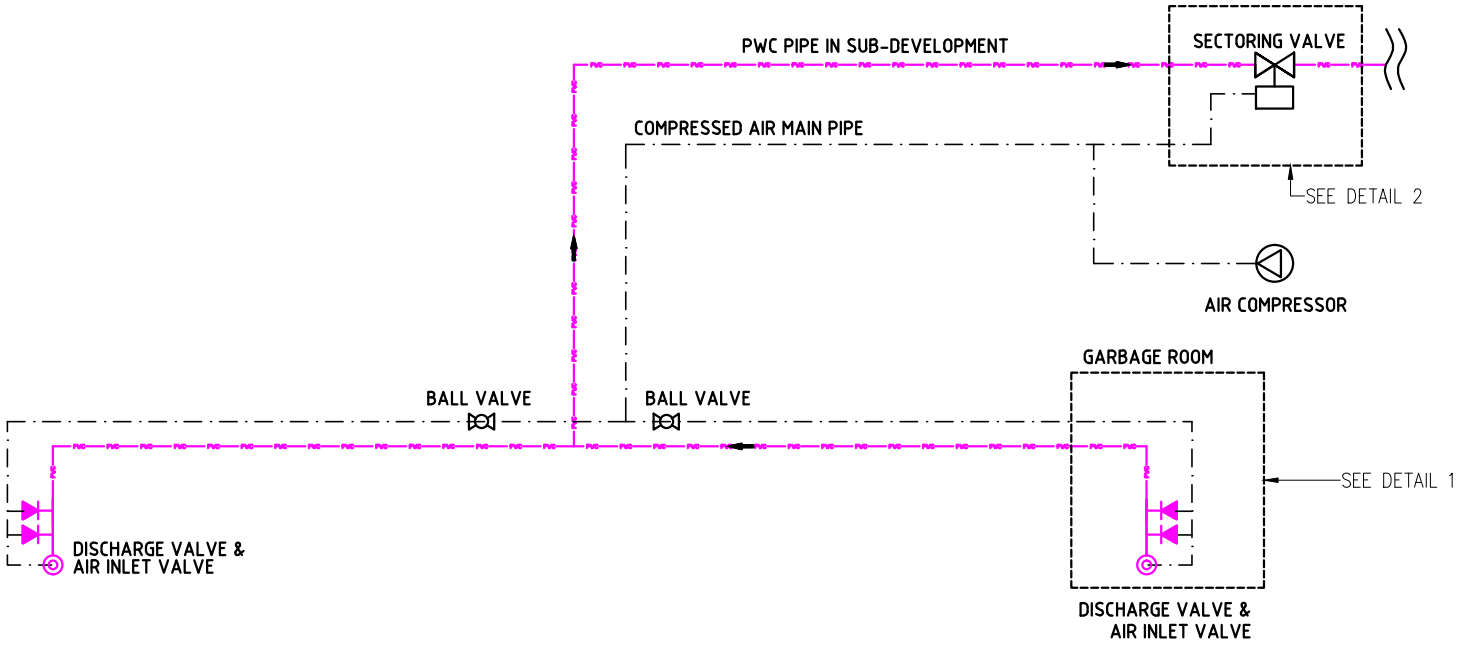
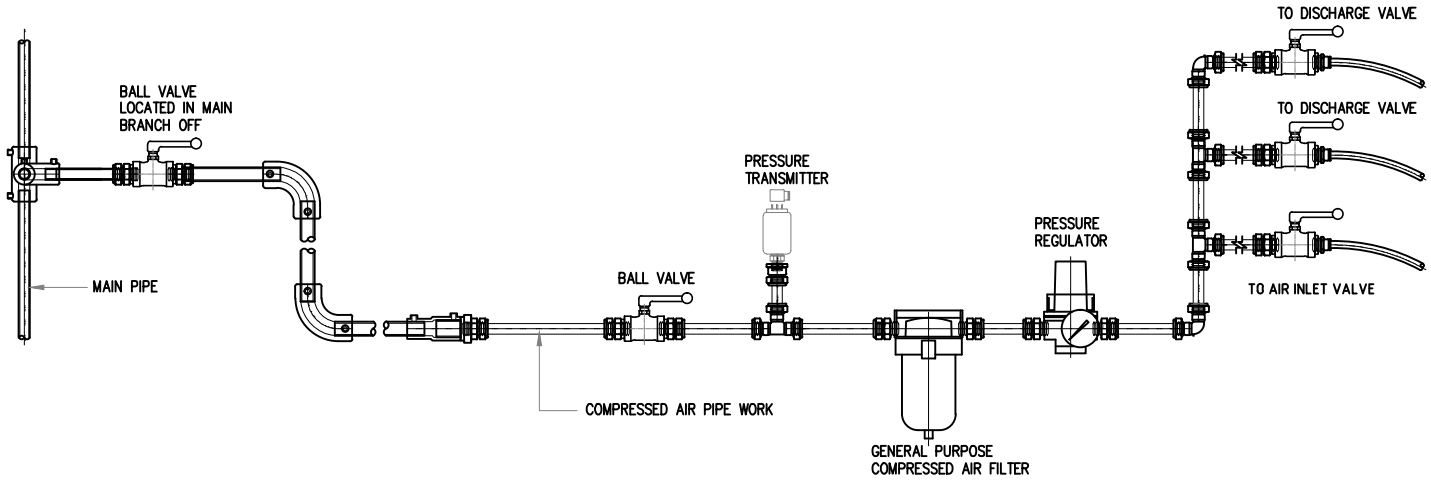
GARBAGE ROOM DETAIL OPTION 2
2 FRACTION WITH 1 CHUTE

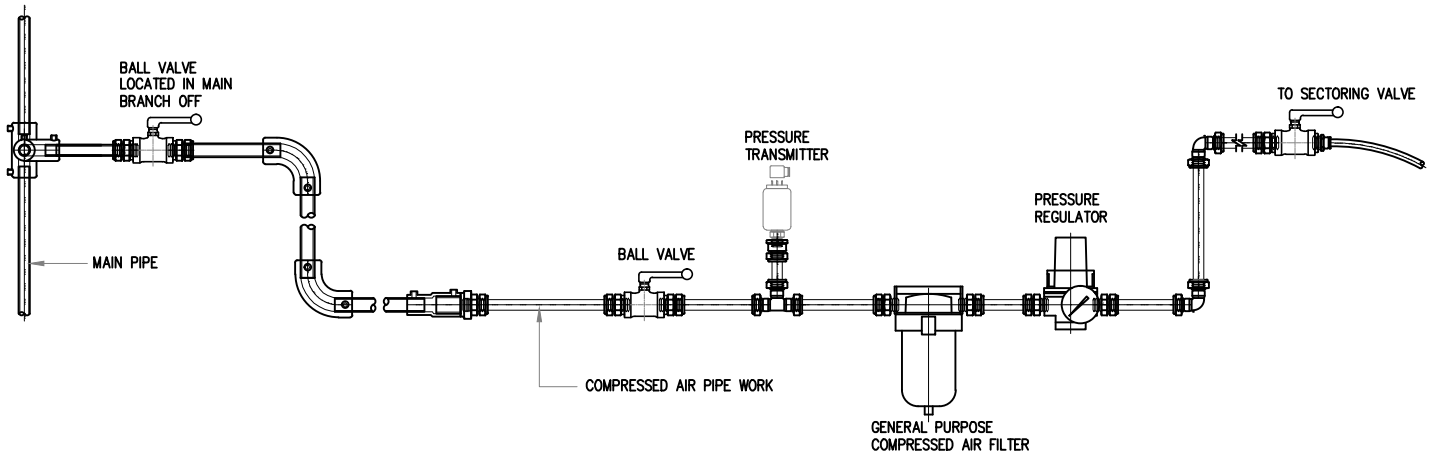
NOT TO SCALE



TYPICAL COMPRESSED AIR SYSTEM SCHEMATIC



DETAIL 1: COMPRESSED AIR SYSTEM TYPICAL ASSEMBLY DETAIL FOR DV ROOM



DETAIL 2: COMPRESSED AIR SYSTEM TYPICAL ASSEMBLY DETAIL FOR SECTORING VALVE

NOTE:
1. ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING.
2. ALL WORKS TO BE DONE BY SUB-DEVELOPER UNLESS OTHERWISE STATED IN THE DRAWING.

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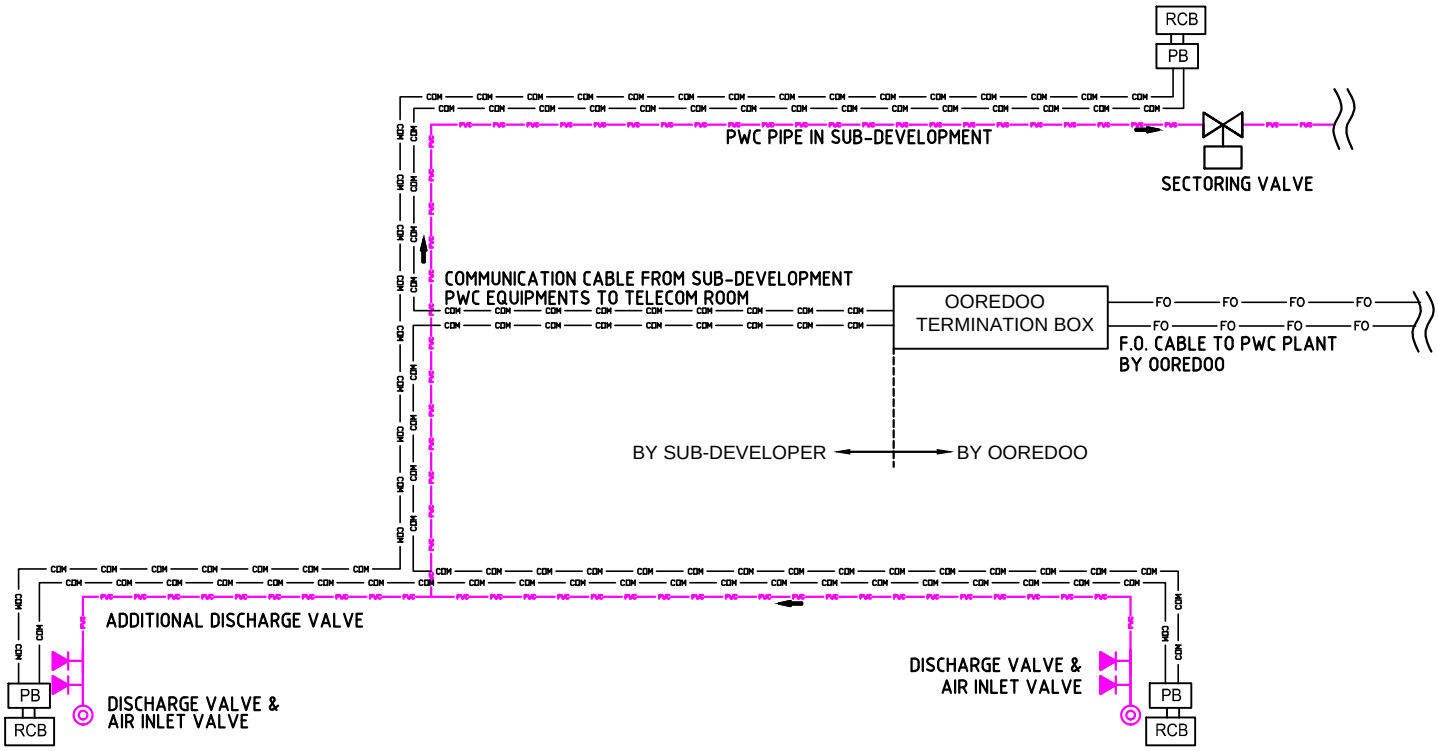
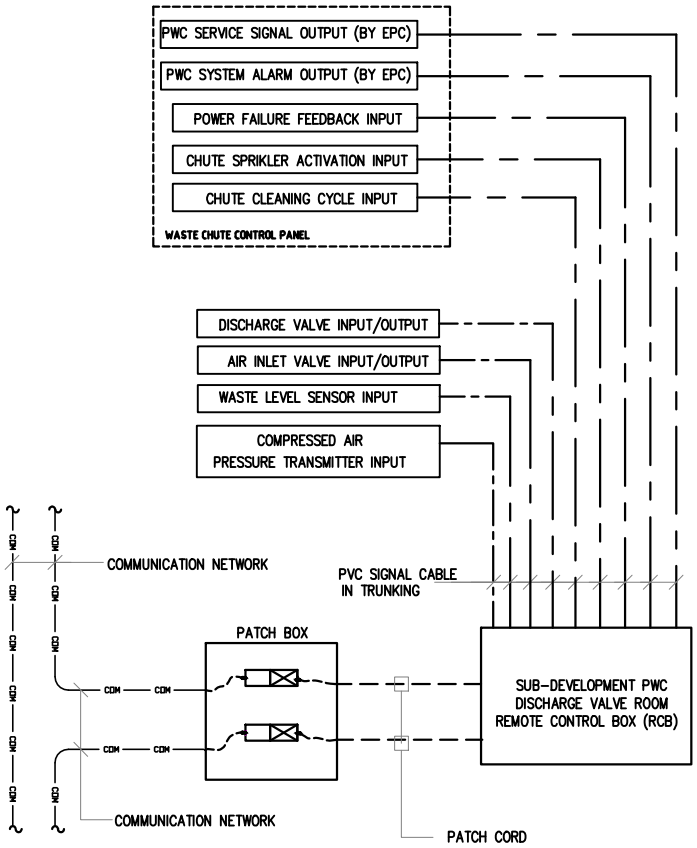
COMPRESSED AIR SYSTEM
TYPICAL DETAIL

NOT TO SCALE

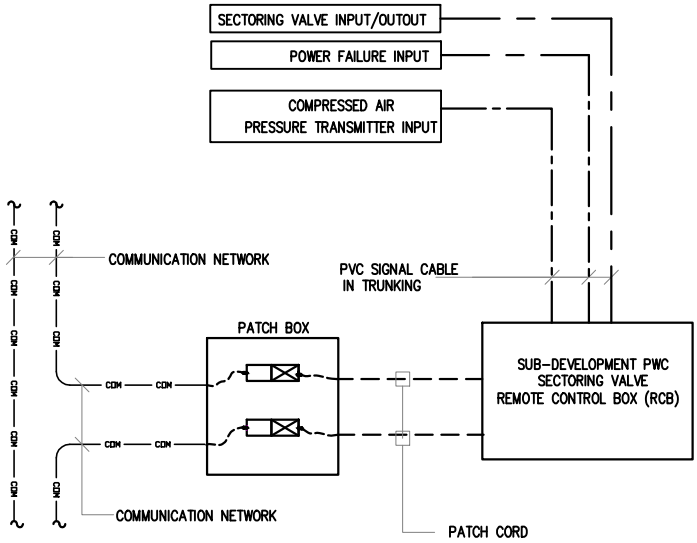


NOTES:
PATCH BOX TO BE PROVIED FOR F.O. CABLE CONFIGURATION

TYPICAL COMMUNICATION CABLE SCHEMATIC



TYPICAL RCB CABLING DETAIL FOR DV ROOM



TYPICAL RCB CABLING DETAIL FOR SECTORING VALVE

NOTE:
1. ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING.
2. INPUT REFER TO AS SIGNAL INPUT TO THE PWC SYSTEM FROM THE COMPONENTS.
3. OUTPUT REFER TO AS SIGNAL OUTPUT FROM THE PWC SYSTEM TO THE COMPONENTS.
4. ALL WORKS TO BE DONE BY SUB-DEVELOPER UNLESS OTHERWISE STATED IN THE DRAWING.
5. REFER TO APPENDIX H FOR THE FULL LIST AND DETAILS OF INPUT AND OUTPUT CONTROL TO PWC SYSTEM.

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ISSUED FOR INFORMATION

COMMUNICATION CABLE
TYPICAL DETAIL

NOT TO SCALE

PWC System IO Monitoring and Control Tabulation for Sub-developer

Appendix H

Input/Output	Designation	Voltage/Current	Normal state	Interface	Remarks	Control Function
Module 1 : 4-20mA Analogue input 4 Channel						
Input 1	Compressed air pressure	4-20mA	Not applicable	Compressed air line	4mA for 0bar pressure	Alarm, stop collection cycle and close SV
Input 2	DV1 Chute waste high level	4-20mA	Not applicable	Waste storage section	4mA- 0% level,20mA-100% level	Initiate collection cycle
Input 3	DV2 Chute waste high level (if any)	4-20mA	Not applicable	Waste storage section	4mA- 0% level,20mA-100% level	Initiate collection cycle
Input 4	Spare	4-20mA	Not applicable	Spare	shall be terminated to terminal block	
Module 2 : 24VDC Digital Input 8 channel						
Input 1	Sectoring Valve (SV) open	24 VDC	Normally open	Reed sensor on cylinder	Sectoring valve open feedback	
Input 2	Sectoring Valve (SV) close	24 VDC	Normally open	Reed sensor on cylinder	Sectoring valve close feedback	
Input 3	RCB power failure	24 VDC	Normally open	Power supply monitoring	Power supply monitoring by ECC lusail	Alarm. Battery/UPS to power RCB
Input 4	Air Inlet Valve (AIV) open	24 VDC	Normally closed	Reed sensor on cylinder	Air Inlet Valve open feedback	Alarm, stop collection cycle and close SV
Input 5	Air Inlet Valve (AIV) close	24 VDC	Normally open	Reed sensor on cylinder	Air Inlet Valve close feedback when finish collection cycle.	Alarm, stop collection cycle and close SV
Input 6	Spare	24 VDC	Spare	Spare	shall be terminated to terminal block	
Input 7	spare	24 VDC	spare	spare	shall be terminated to terminal block	
Input 8	spare	24 VDC	spare	spare	shall be terminated to terminal block	
Module 3 : 24VDC Digital Input 8 channel						
Input 1	DV1 closed	24 VDC	Normally open	Reed sensor on cylinder	Discharge valve close feedback	Alarm, stop collection cycle and close SV
Input 2	DV1 open	24 VDC	Normally open	Reed sensor on cylinder	Discharge valve open feedback	Alarm, stop collection cycle and close SV
Input 3	Fire sprinkler in waste chute	24 VDC	Normally open	Chute CB, voltage free contact	Fire in DV-1 chute,lock sectoring valve	Alarm, stop collection cycle and close SV
Input 4	Chute cleaning start sequence	24 VDC	Normally open	Chute CB, voltage free contact	DV-1 chute cleaning on going	Alarm, stop collection cycle and close SV
Input 5	spare	24VDC	spare	spare	shall be terminated to terminal block	
Input 6	spare	24VDC	spare	spare	shall be terminated to terminal block	
Input 7	spare	24VDC	spare	spare	shall be terminated to terminal block	
Input 8	spare	24VDC	spare	spare	shall be terminated to terminal block	
Module 4 : 24VDC Digital Input 8 channel.						
Input 1	DV-2 closed feedback	24 VDC	Normally open	Reed sensor on cylinder	Discharge valve close feedback	Alarm, stop collection cycle and close SV
Input 2	DV-2 open feedback	24 VDC	Normally open	Reed sensor on cylinder	Discharge valve open feedback	Alarm, stop collection cycle and close SV
Input 3	Emergency stop contact	24VDC	Normally closed	Emergency stop button	Lock DVs,Sectoring valve & Stop collection cycle of RCB	Alarm, stop collection cycle and close SV
Input 4	General fire alarm	24VDC	Normally closed	From fire alarm panel of BMS		Alarm, stop collection cycle and close SV
Input 5	spare	24VDC	spare	spare	shall be terminated to terminal block	
Input 6	spare	24VDC	spare	spare	shall be terminated to terminal block	
Input 7	spare	24VDC	spare	spare	shall be terminated to terminal block	
Input 8	spare	24VDC	spare	spare	shall be terminated to terminal block	

PWC System IO Monitoring and Control Tabulation for Sub-developer

Appendix H

Input/Output	Designation	Voltage/Current	Normal state	Interface	Remarks	Control Function
Module 5 :-24VDC Digital Output 8 channel.						
Output1	Open Sectoring valve	24 VDC	Not applicable	Cylinder magnetic actuator		
Output2	Open Air Inlet Valve	24 VDC	Not applicable	Cylinder magnetic actuator		Open AIV and lock chute door
Output3	Open DV-1	24 VDC	Not applicable	Cylinder magnetic actuator	During collection mode, Chute door to lock by Sub-developer	To lock chute door and stop chute diverter
Output4	Open DV-2	24 VDC	Not applicable	Cylinder magnetic actuator	During collection mode, Chute door to lock by Sub-developer	To lock chute door and stop chute diverter
Output5	PWC Plant system Alarm	24VDC	Not applicable	Light indication on RCB	Light indication on RCB panel	To lock chute door and stop chute diverter
Output6	Spare	24VDC	Not applicable	Spare	shall be terminated to terminal block	
Output7	Spare	24VDC	Not applicable	Spare	shall be terminated to terminal block	
Output 8-1	Spare	24VDC	Not applicable	Spare	shall be terminated to terminal block	
General					**Remarks**	
a) Type of PLC					PLC/Smart RTU	
b)Communication protocol					Modbus TCP/IP	
c) IP Rating					IP 54	
d) Type of communication cable					CAT-6 or Fiber optic	

Notes:

1. The above tabulation is based on typical buidling with single garbage room.
2. Additional module to be added for buidling with more than one garbage room.
3. All the input and output of PLC shall be wired back to fuse terminal blocks
4. BS 1363 230VAC single gang socket with switch shall be provided inside the RCB
5. Instrument and potential earth block shall be installed in the RCB
6. I&C As-builts Diagram Drawings pocket shall be provided inside the RCB enclosure.
7. Power, SV, AIV, DV, Chute diverter and emergency stop status indicator shall be provided in the RCB face plate

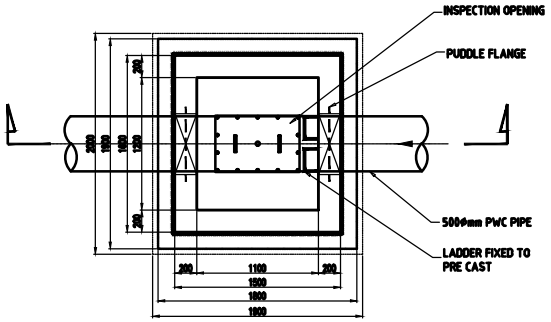
APPENDIX I

Minimum deliverables for sub-developer RCB

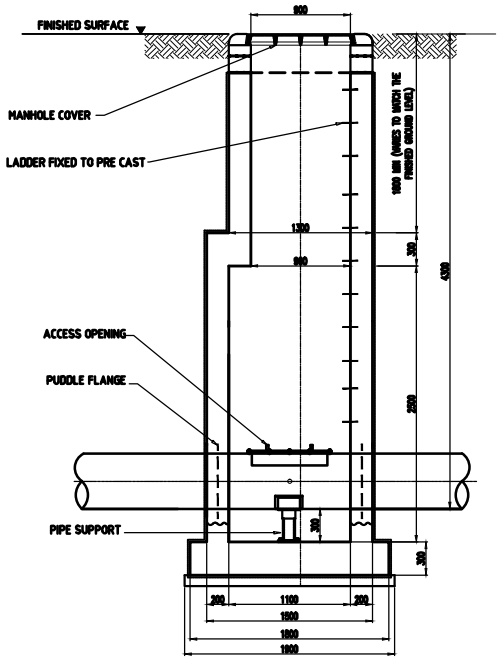
The Contractor shall provide the following:

1. General arrangement of equipment inside control panel & mounting height.
2. Gland plate details.
3. 230 VAC and 24VDC wiring diagram.
4. System architecture /PLC rack layout.
5. Cable block diagram.
6. PLC card input /output wiring diagram.
7. Instrument hook-up diagram.
8. Fittings assembly diagram.
9. Fused terminal block wiring diagram.
10. Schematic diagram of chute with equipment & sensors mounting details.
11. Cable routing and pneumatic piping layout.
12. Data sheets and manuals for all components of PWC system.
13. Input output list as per projects requirements.
14. UPS backup time calculation for minimum 2 hours.
15. 24VDC panel load list.
16. Details BOQ of RCB.
17. Tagging and labeling

APPENDIX J

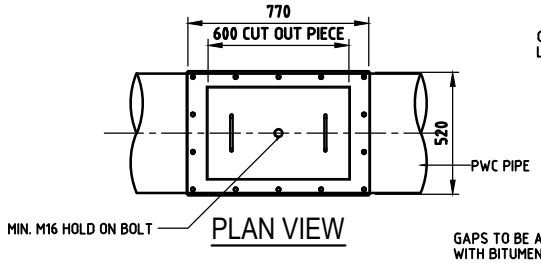


PLAN VIEW

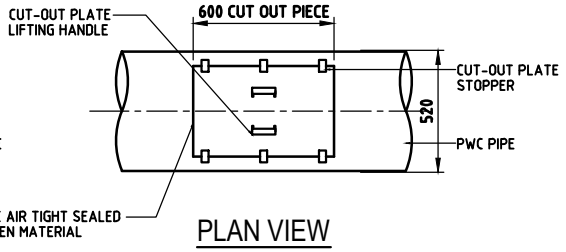


SECTION

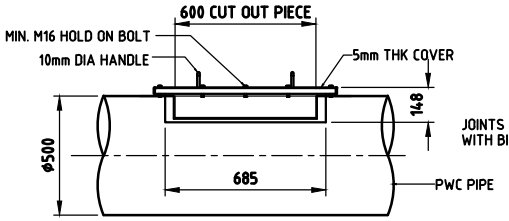
RC CHAMBER FOR INSPECTION OPENING TYPICAL DETAIL



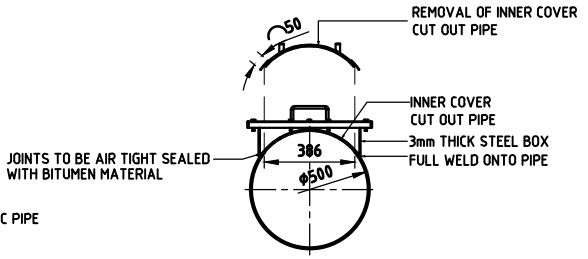
PLAN VIEW



PLAN VIEW



SIDE VIEW



SECTION VIEW

INSPECTION OPENING TYPICAL DETAIL

NOTE: ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING

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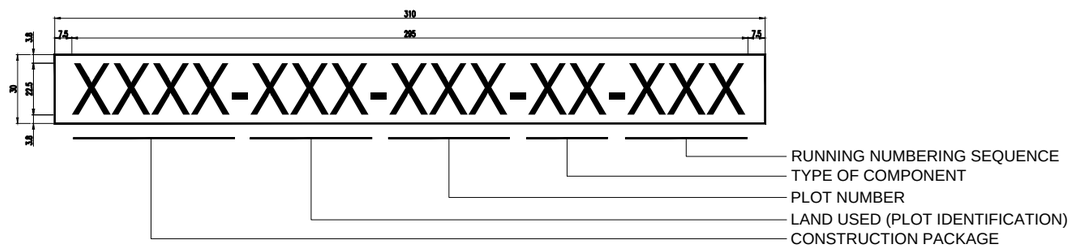
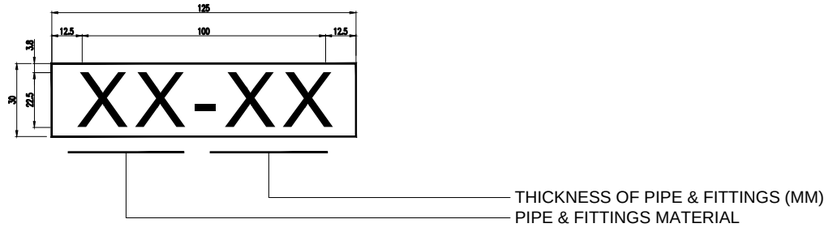
SUB-DEVELOPER RC CHAMBER & INSPECTION OPENNG TYP. DETAILS

NOT TO SCALE

APPENDIX K1



PWC EQUIPMENT TAGGING FOR SUB-DEVELOPERS PLOT



NOTE: TAGGING TO BE APPLIED AT THE END OF EACH PIPE & FITTINGS

PIPE & FITTINGS TAGGING

CONSTRUCTION PACKAGE	
SYMBOL	DESCRIPTION
0001	MARINA DISTRICT
7A1A	SEEF LUSAIL SOUTH
7A1B	SEEF LUSAIL NORTH
007B	LUSAIL PLAZA
7C1B	BOULEVARD COMMERCIAL
013C	PWC PLANT ROOM

SYSTEM NUMBER	
SYMBOL	DESCRIPTION
X	NOT APPLICABLE
1	SYSTEM 1
2	SYSTEM 2

DISTRICT SUB-BOUNDARY	
SYMBOL	DESCRIPTION
N	NORTH
E	EAST
W	WEST
S	SOUTH
X	NOT APPLICABLE

TYPE OF EQUIPMENT	
SYMBOL	DESCRIPTION
DV	DISCHARGE VALVE
AV	AIR INTAKE VALVE
SV	SECTORING VALVE
IO	INSPECTION OPENING
LS	WASTE LEVEL SENSOR
RB	REMOTE CONTROL BOX
AS	COMPRESSED AIR SENSOR

LAND USED	
SYMBOL	DESCRIPTION
RES	RESIDENTIAL
CIV	CIVIC
COM	COMMERCIAL & RETAIL
MIX	MIXED LAND USED
HOT	HOTEL
MOS	MOSQUE

PIPE & FITTINGS MATERIAL	
SYMBOL	DESCRIPTION
CS	CARBON STEEL

LABEL SPECIFICATION	
BACKGROUND COLOR	WHITE
LETTER COLOR	BLACK
LETTER FONT	ARIAL
STICKER MATERIAL	INDUSTRIAL HEAVY DUTY

NOTE: ALL UNITS ARE IN MILLIMETER UNLESS OTHERWISE STATED IN THE DRAWING

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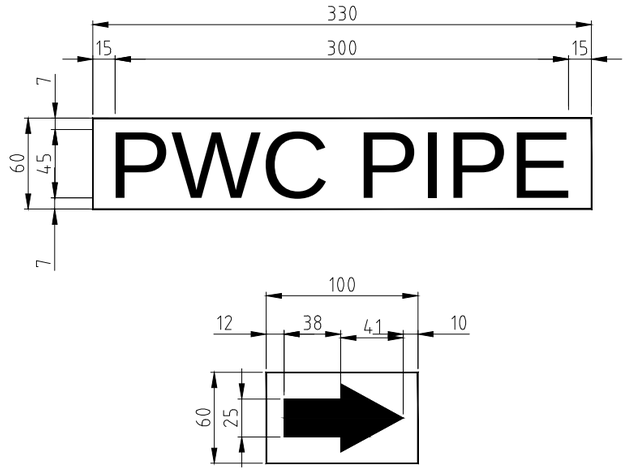
ISSUED FOR INFORMATION

SUB-DEVELOPER PWC SYSTEM
STANDARD TAGGING DETAILS-1

NOT TO SCALE

APPENDIX K2

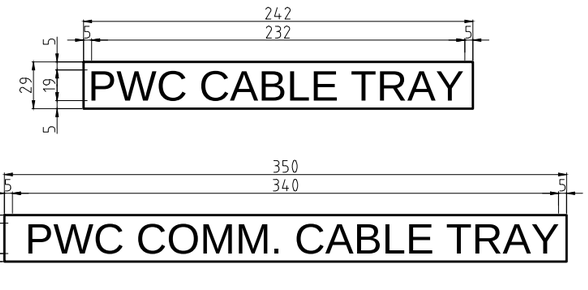


NOTE: LABEL SHALL ALSO BE APPLIED FOR THE EXPOSED PIPE INSIDE RC CHAMBER

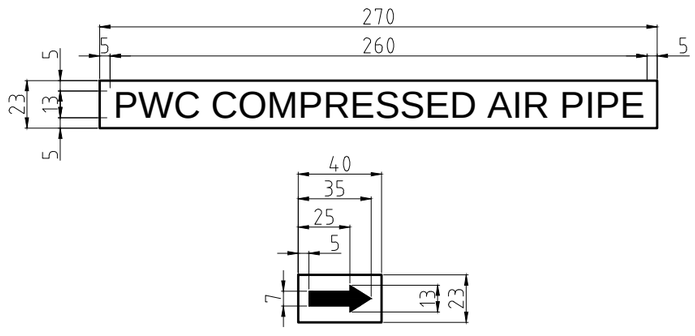
LABELING FOR Ø500mm PWC ABOVEGROUND/EXPOSED PIPE

STANDARD: EN 12613
WIDTH: 300 mm
LENGTH: 1000mm, CONTINUOUS
THICKNESS: 250 MICRONS
TEXT HEIGHT: 75mm

DETECTABLE WARNING TAPE FOR UNDERGROUND PWC PIPE



LABELING FOR PWC CABLE TRAY



NOTE: LABEL SHALL ALSO BE APPLIED FOR THE EXPOSED PIPE INSIDE RC CHAMBER

LABELING FOR PWC COMPRESSED AIR PIPE

LABEL SPECIFICATION	
BACKGROUND COLOR	WHITE
LETTER COLOR	BLACK
LETTER FONT	ARIAL
STICKER MATERIAL	INDUSTRIAL HEAVY DUTY

LABEL MATERIAL AND SPECIFICATION

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ISSUED FOR INFORMATION

SUB-DEVELOPER PWC SYSTEM
STANDARD TAGGING DETAILS-2

NOT TO SCALE

Waste ALLOWED — نفايات مسموح بها

RECYCLABLE — يمكن اعادة تدويرها

PAPER الاوراق

Newspapers, magazines and small boxes not more than 30cm

الصحف , المجلات و غيرها من الاوراق المستعملة والعبوات الكرتونية التي لايزيد حجمها عن 30 سم

PLASTIC البلاستيك

bags, cups and bottles

اكياس و عبوات البلاستيك

METAL cans & GLASS bottles

العبوات المعدنية والزجاجية

CLOTHES and SMALL TEXTILES
الملابس والمنسوجات الصغيرة

Only dispose clothes and textiles that can't be donated to charity

تخلص فقط من الملابس التي لا يمكن التبرع بها للجمعيات الخيرية

NON-RECYCLABLE — غير ممكن اعادة تدويرها

BAGGED FOOD WASTE

اكياس فضلات الطعام

(TIED in allowable size plastic bag or paper bag)

يجب أن تكون مخلفات الطعام داخل اكياس مغلقة

WOOD الخشب

Wood chips and small lumber no longer than 30cm

نفايات الخشب المكسور التي لا تتجاوز 30 سم

Waste NOT ALLOWED — نفايات غير مسموح بها

BULKY WASTE النفايات كبيرة الحجم

Cardboards, Mattresses, furniture, kitchen appliances, large items of waste etc.

الخزائن ، المراتب، الاثاث، معدات المطبخ وغيرها من المواد كبيرة الحجم.

CONSTRUCTION & REFURBISHMENT WASTE

مخلفات البناء والترميم

HAZARDOUS WASTE خطرة نفايات

Chemicals, combustible and inflammable substances likely to cause fire or explosion

المواد التي قد تسبب في اشتعال النار او تحدث انفجار والكيماويات المختلفة

OFFENSIVE WASTE نفايات كريهه

Dead animals, feces and strong odorous substances

حيوانات نافقة ، ومواد ذات رائحة نفاذة

LIQUID and VISCOUS WASTE
النفايات السائلة واللزجة

Oils, glycerin, tar and sulfuric acids

Wastewater, juices and chemicals

الزيوت ، الاحماض الكيماوية، زيوت التشحيم، المياه العادمة

MEDICAL WASTE النفايات الطبية

Syringe, blood bags and other contaminated medical waste

مثل الحقن الطبية ، عبوات الدم وغيرها من المخلفات الطبية

Important reminders:

Please ensure you DO NOT dispose prohibited waste into the waste chutes.

Prohibited wastes are indicated above in red; Additional information as below;

- **Bulky waste that does not fit in the inlet is prohibited.**
  - **O Maximum size for compressible waste is 400X400mm**
  - **O Maximum size for non-compressible single waste is 300x300mm**
- **Please keep the inlet area clean as a courtesy to the next user.**

تذكيرات مهمة

يرجى التأكد من عدم التخلص من النفايات المحظورة في صناديق النفايات.

- **يشار إلى النفايات المحظورة أعلاه باللون الأحمر ؛ معلومات إضافية على النحو التالي**

يحظر النفايات الضخمة التي لا تناسب المدخل.

الحجم الأقصى للنفايات القابلة للضغط هو 400 □ x 400 mm

الحجم الأقصى للنفايات الفردية غير القابلة للانضغاط هو 300 □ x 300 mm

- **يرجى الحفاظ على المنطقة نظيفة للمستخدم التالي**

EMERGENCY NO.: 4497 7666 / 3144 3141

رقم الطوارئ: 4497 7666 / 3144 3141