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, recycle 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 bottles, aluminum cans, paper, cardboard, etc.
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.

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 a number 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
4.0 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:

<table>
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<tr>
<th>Type of Waste</th>
<th>Mixed Household (apartments)</th>
<th>Offices/Hotels</th>
<th>Pedestrian</th>
<th>Bulky</th>
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<tr>
<td>Commercial Boulevard</td>
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<td>Traditional</td>
<td>Traditional</td>
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<tr>
<td>All Other Areas</td>
<td>Traditional</td>
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<td>Traditional</td>
<td>Traditional</td>
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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 may not be operational before 2016. The Customer shall be responsible to provide temporary measure to handle the Municipal Solid Waste (MSW) conventionally until the PWC system is available.
5.0 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.
5. The air that is used to transport the waste is cleaned of all debris by a **Filtration System** (G) and the odour is removed by a **De-odorising 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, a 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.
6.0 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.

6.1 Types of Waste Generated

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

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 or 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 also cannot be handled by the PWC system:-

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

b) Glass in excess of 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) that exceeds 10% of by weight of waste bag

f) Biological, medical, hazardous and industrial waste
g) Dead animal carcasses.

h) Faeces

The waste size, bagged or otherwise, shall be less than 300mm measured in any direction, in this respect, 3D volume-controlled hoppers door shall be provided by the customer for each waste chute inlet to restrict and prevent the entry of long or bulky waste into the waste chutes.

Notices 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 to 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.

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 3,600litres/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 works. 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 compartment 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. In the event that 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.

6.2 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) at each floor. The chutes shall be compliant with the requirements of the 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 a negative pressure in the chute eliminating odors escaping from the chute into the waste disposal rooms.
b) Chute cleaning and fire sprinkler shall be provided as per local Authorities requirement. Activation signal from these provisions should be connected to the PWC system Remote Control Box to terminate the waste transport cycle. During waste unloading cycle, a signal from the PWC system will also be provided to the chute control panel to lock all waste inlet doors.

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

d) The temporary storage section complete with waste level switch 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.

e) Air Intake Valve to allow fresh air intake during the transport cycle provide 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.

f) 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.

g) Inspection piece or access cover 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 degree 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.

h) 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.

Long radius bends (minimum 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 1250mm radius bend is used.

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

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.

i) 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 Appendix G for typical communication cable installation detail.

j) Pipe sleeves for auxiliary services are provided together with the PWC pipe to each plot boundary tie-in point. Customer shall provide sleeve continuity from the tie-in point into the building.

k) Adequate space for 100mm wide and 25mm high cable tray to house the auxiliary services mentioned in item h) and i) should also be provided adjacent to the PWC pipe network.

l) 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 kw to provide minimum 6 bar pressure, air flow rate of 15lit/hr. Please refer Appendix F for typical installation detail.

m) 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 Lusail. Customer shall design the PWC network based on the as-built or design information of the PWC tie-in pint. 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.

n) PWC equipments, 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 reputable PWC system specialist available in Qatar. Recommended PWC system
specialist are as follows:

i) Envac Qatar WLL

ii) Stream Environment

iii) Ros Roca

Specifications for the above mentioned PWC equipments shall be issued to ensure the compatibility with the main PWC system in Lusail City.

o) Pipe continuing from the tie-in point shall be isolated with flange insulation kits to electrically isolate the pipe from the main infrastructure buried pipe. Pipe at downstream of the isolation joints shall not be in contact with metallic structure works.

6.3 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.

6.4 General Work by Customer for PWC system

6.4.1 General Items

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

b) Provision of all floor and wall penetrations for the pipes, including opening sleeves where necessary. Drawings indicating the size and location of the required wall opening shall be provided by the PWC system contractor.

c) Design, supply and construction of watertight manhole chambers for underground pipe below the floor slab 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 purposes. This valve will require 75mm ND drain pipe adjacent to its location for general cleaning and maintenance. Gap of 1000mm on the pipe network for future installation of sectoring valve.

e) Areas where transport pipes are exposed to sensitive area and may require acoustic
treatment. These areas will add to overall dimension of pipe increasing the 500mm ND to 600mm ND for standard rock wool insulation. Generally, PWC system pipe installed in basement car park does not require acoustic insulation as any noise generated from the waste moving in the pipe will only happen during the transport mode and intermediary.

f) Others general items mentioned in Appendix C

6.4.2 Discharge Valve Room

a) Provision of all building and civil works, all architectural works including finishes and fixtures. Room structure and finishing shall be designed to withstand negative pressure.

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

c) Provision of room ventilation, opening for discharge valve or air inlet valve air intake including louvers, ducts, silencers and fire dampers if necessary.

d) Provision of acoustic treatment to valve rooms where necessary. This includes all acoustic treatment to Architect's or acoustic specialist's detail; including but not limited to the installation of acoustic lining to walls and ceiling and provision of acoustic doors.

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

f) 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 equipments are provided with the necessary relay, switches, sensor and transmitter, and also appropriate signal cable to the control boxes.

g) Independent air compressor and compressed air system network to all PWC equipments.

h) Electrical isolation kits flange joints.

i) The PWC scope of works within the Customer are shown in Appendix C

6.4.3 RCB Programming Logic Controller (PLC) and Communication specifications

a) RCB PLC programming shall comply IEC 61131-3 standard for PLC programming languages.
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 be monitored and locally controlled manually and remotely 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) Provide Standard nameplates for cabinet/enclosure.

j) The system must support open network 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 Ooredoo's Telecom Room will be laid provided that the distance between the RCB to Telecom room does not exceed 90 meters and the bandwidth requirement for end points are satisfied. For distance above 90 meters, fiber optic single mode redundant (2x2F) cable is recommended. Media convertor and any accessories required for communication up to Ooredoo’s Telecom Room shall also be installed.

7.0 TRADITIONAL WASTE COLLECTION SYSTEM

This system involves the collection of wastes 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 without much change in design.

The various guidelines mentioned below addresses 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.

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 for 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 shall be located in such a way to facilitate removing (by human or vehicles) the containers and transporting them 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 meter (and to suit size of container) with doors opening upwards and swinging out
- Garbage rooms shall be provided with adequate lighting and ventilation or air conditioning for summer.
- Floors and walls shall be of ceramic tiles to 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 screen to retain solid material. Floor drain traps shall be readily accessible for cleaning. Water for cleaning, grease interception to be decided by the consultant to municipal requirement.
- The minimum internal corridor width of the garbage room shall be 1.2 meter
- 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 to provide the design of garbage room to suit all local authorities' requirement and applicable international standards.

The typical 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 shall operate automatically with spray heads at 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 container.

The chutes should not be sited close to habitable rooms to avoid noise disturbances.

3D Volume control shall be implemented at each hopper level in order to prevent the residents from dumping unacceptable material such as carpets, corrugated cardboard, etc. in the chutes.

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 reducing 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 specifications 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 wastes 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 uncompacted 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

Garbage Bin typical dimensions (in mm) for 1100 L, 660 L and 360L Wheelie Bins or MGBs (Mobile Garbage Bins)

<table>
<thead>
<tr>
<th>Garbage Bin</th>
<th>Dimensions</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100 Eurobin</td>
<td>Height - 1370</td>
<td>15-18 bags of waste</td>
</tr>
<tr>
<td></td>
<td>Width - 1260</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depth - 990</td>
<td></td>
</tr>
<tr>
<td>660 Eurobin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 1100 Eurobin

- Height: 1370 mm
- Width: 1260 mm
- Depth: 730 mm
- Capacity: 10-12 bags of waste

### 360 Wheelie Bin

- Height: 1100 mm
- Width: 880 mm
- Depth: 665 mm
- Capacity: 5-6 bags of waste

*Note: All measurements are in mm, see manufacturer’s details for exact dimensions.*

### Typical Skip’s dimensions

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>1100ltr +/- 6%</td>
</tr>
<tr>
<td>Maximum Load</td>
<td>440 kg</td>
</tr>
<tr>
<td>Weight</td>
<td>105 kg</td>
</tr>
<tr>
<td>Material</td>
<td>Body: Hot dip galvanized steel (optional coating)</td>
</tr>
<tr>
<td></td>
<td>Lid: HPDE, UV Stabilized</td>
</tr>
<tr>
<td>Wheels</td>
<td>4 rubber wheels, Ø200mm</td>
</tr>
<tr>
<td>Lifting Trunnions</td>
<td>Add on</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Width 1260mm, Height 1360mm, Depth 1000mm</td>
</tr>
<tr>
<td></td>
<td>Handle to ISO standard to match truck</td>
</tr>
</tbody>
</table>
### TECHNICAL DATA

<table>
<thead>
<tr>
<th>TYPE</th>
<th>CAPACITY (Liters)</th>
<th>LENGTH mm</th>
<th>WIDTH mm</th>
<th>HEIGHT mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIN - 1.1</td>
<td>1,100</td>
<td>940</td>
<td>1220</td>
<td>1440</td>
</tr>
<tr>
<td>BIN - 2.5</td>
<td>2,500</td>
<td>1275</td>
<td>1625</td>
<td>1220</td>
</tr>
<tr>
<td>BIN - 4.5</td>
<td>4,500</td>
<td>1729</td>
<td>2090</td>
<td>1160</td>
</tr>
<tr>
<td>SC - 5</td>
<td>5,000</td>
<td>3500</td>
<td>1220</td>
<td>1220</td>
</tr>
<tr>
<td>SC -10</td>
<td>10,000</td>
<td>2440</td>
<td>1860</td>
<td>2200</td>
</tr>
<tr>
<td>SC -12</td>
<td>12,000</td>
<td>4446</td>
<td>2440</td>
<td>1100</td>
</tr>
<tr>
<td>SC -18</td>
<td>18,000</td>
<td>4446</td>
<td>2440</td>
<td>1600</td>
</tr>
</tbody>
</table>

Note: Different manufacturers produce skips of varying dimensions. The above mentioned are typical and as a guide for the Customers.
8.0 CODES & STANDARDS

The materials and equipment supplied and installed shall, at a minimum, conform to the requirements of local standards and the codes listed below. When an edition date is not indicated for a code or standard, the latest edition in force at the time of contract award and implementation shall apply.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>QCS</td>
<td>Qatar Construction Specifications</td>
</tr>
<tr>
<td>Kahramaa</td>
<td>Qatar General Electricity &amp; Water Corporation</td>
</tr>
<tr>
<td>QCD</td>
<td>Qatar Civil Defence</td>
</tr>
<tr>
<td>EN</td>
<td>European Standards</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>BSI</td>
<td>British Standards Institute</td>
</tr>
<tr>
<td>CIBSE</td>
<td>Chartered Institution of Building Services Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society of Testing and Materials</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organisation</td>
</tr>
</tbody>
</table>
9.0 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 fraction with 2 chutes
D2 – Garbage room detail Option 1, 2 fraction with 2 chutes
E1 - PWC DV room detail Option 2, 2 fraction with 1 chute
E2 - Garbage room detail Option 2, 2 fraction with 1 chute
F – Compressed air system typical detail
G – Communication cable typical detail
H – PWC system main Input / Output List
A - HOOPPER DOOR WITH VOLUME CONTROL
B - DISCHARGE VALVE (DV)
C - WASTE TEMPORARY STORAGE
D - PRIMARY AIR INLET (AIR INLET VALVE)
E - RECEIVING VALVE WITH UC CHAFTER
F - PWC TRANSPORT PIPE (INFRASTRUCTURE)
G - FILTER HOUSE
H - SECO FILTER
J - WASTE SEPARATOR
K - WASTE COMPACTOR
L - WASTE CONTAINER
M - PWC PLANT ROOM

TYPICAL PWC SCHEMATIC DIAGRAM

ISSUED FOR INFORMATION

NOT TO SCALE
TYPICAL PWC PIPE NETWORK LAYOUT PLAN

TYPICAL FLANGE FOR PWC EQUIPMENTS

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

ISSUED FOR INFORMATION

PIPE TURNING AND TEE-OFF DETAILS

NOT TO SCALE
## PWC Scope of work within sub-developer

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Customer</th>
<th>Marafeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supply and install all PWC equipments inside DV room</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Supply and install all PWC pipe network within Customer plot boundary limit</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Supply and install the complete compressed air system within Customer plot boundary limit</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Supply and install the complete communication cable to control boxes</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Connection of PWC pipe from the Customer building to the existing infrastructure pipe</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Connection of communication cable to infrastructure junction box</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Dry testing of all control cable within sub-development</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Testing and commissioning of Customer's PWC system with the PWC plant room equipment</td>
<td>✔️ ✔️</td>
<td></td>
</tr>
</tbody>
</table>
WASTE CHUTE LAYOUT PLAN

DV ROOM LAYOUT PLAN

APPENDIX D1

ISSUED FOR INFORMATION

NOT TO SCALE

PWC DV ROOM DETAIL OPTION 1
2 FRACTION WITH 2 CHUTES

Marafaq Qatar
APPENDIX F

TYPICAL COMPRRESSED AIR SYSTEM SCHEMATIC

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

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

NOTE:

1. ALL UNITS ARE IN POLITICAL UNITS OF THE DRAWING.
2. ALL WORKS TO BE COMPLETED UNTIL HANDBACK OF THE DRAWING.

ISSUED FOR INFORMATION

COMPRESSED AIR SYSTEM
TYPICAL DETAIL

NOT TO SCALE
## PWC System Monitoring and Control Tabulation for SCADA system

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>Digital Input</th>
<th>Digital Output</th>
<th>Analogue Input</th>
<th>Analogue Output</th>
<th>RCB required</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A - Sub-Developer and Field Components</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>One RCB shall be provided for each DV room components.</td>
</tr>
<tr>
<td>1. Discharge Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Unloading door to open/close</td>
<td>0 1 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Unloading door open feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Unloading door close feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Air Inlet Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Damper plate to open/close</td>
<td>0 1 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Damper plate open feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Damper plate close feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Waste Level Sensor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Level sensor activation feedback</td>
<td>0 0 1 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sectoring Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>a) Isolation plate to open/close command.</td>
<td>0 1 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Isolation plate open feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Isolation plate close feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. General</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Compressed air pressure feedback</td>
<td>0 0 1 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) RCB power failure feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Waste Chute or Bin Cleaning Feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Waste Chute or Bin fire sprinkler activation feedback</td>
<td>1 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) PWC system service signal to Waste Chute Panel</td>
<td>0 1 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) PWC system alarm to Chute panel</td>
<td>0 1 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>