Drehid MBT Facility

Heat Transfer between Drehid Waste Management Facility and Drehid MBT Facility

1. INTRODUCTION

Both Configuration A (MBT with Composting) and Configuration B (MBT with Dry Anaerobic Digestion (AD) and Composting) will use process heat primarily to permit drying of the Solid Recovered Fuel (SRF) fraction in order to improve its fuel characteristics.

Under Configuration A (MBT with Composting), process heat will be provided by a CHP system (operating on landfill gas) at the existing Drehid Waste Management Facility.

Under Configuration B (MBT with Dry Anaerobic Digestion and Composting), process heat will be provided by a CHP system (operating on biogas generated by the dry AD process) at the MBT Facility. The balance of the process heat required by the MBT Facility will be provided by a CHP system (operating on landfill gas) at the existing Drehid Waste Management Facility.

Outline schematics of the heat flow regime in Configuration A (MBT with Composting) and Configuration B (MBT with Dry Anaerobic Digestion and Composting) are shown in Figures A and B respectively.

Figure A: Configuration A (MBT with Composting) – Heat Flows

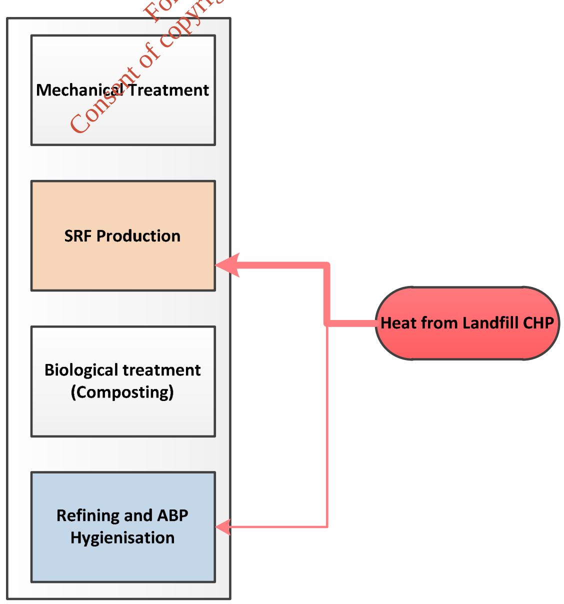
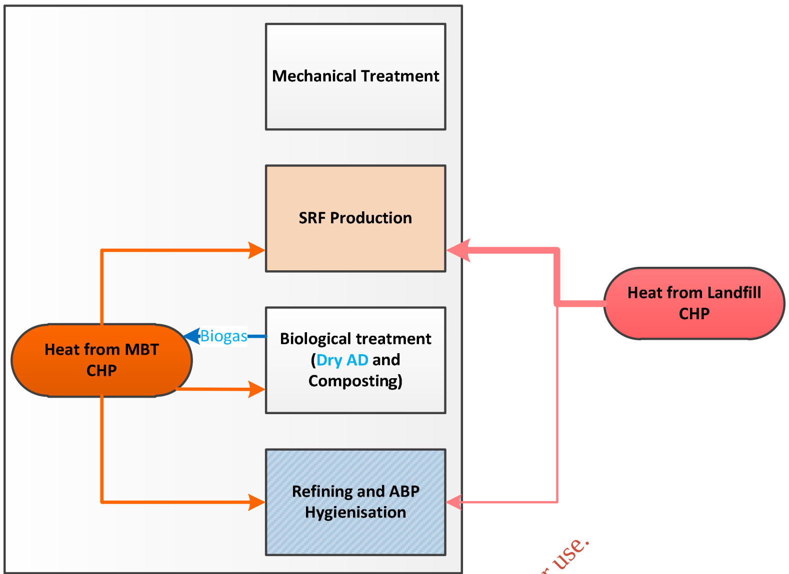


Figure B: Configuration B (MBT with Dry Anaerobic Digestion and Composting) – Heat Flows



2. HEAT DELIVERY SYSTEM FROM DREHID WASTE MANAGEMENT FACILITY TO MBT FACILITY

The CHP system (operating on landfill gas) at the Drehid Waste Management Facility will comprise of four landfill gas engines. Planning permission has already been granted for the development of a landfill gas engine compound at the existing Drehid Waste Management Facility.

Heat transfer will be by hot water, at approximately 180°C and approximately 20 bar pressure, over a distance of approximately 1,300m between a landfill gas engine compound at the existing Drehid Waste Management Facility and the SRF Building at the MBT facility.

A schematic drawing of the heat delivery system is attached separately. The heat delivery system comprises the following main components:

1 **Air/water Landfill Gas Engine Heat Exchanger System:** Each of the four engines in the landfill gas engine compound will utilise an exhaust gas heat exchanger and engine exhaust bypass (for system control). There will also be a second heat exchanger (on engine cooling fluids) if more heat energy input is required.
2 **Heat Transfer Circulation Pipework:** Pipework will connect the landfill gas engine heat exchangers with the air/water heat exchanger at the SRF Dryer within the SRF Building at the MBT facility. The pipework system will be constructed using a twin 50mm nominal diameter insulated steel pipe (DN50, flow and return), with associated circulating pumps, expansion tank and expansion loops in the pipework. In Configuration A (MBT with Composting), a spur from this heat transfer line will also deliver heat to the pasteurisation process in the Refining Building. The outward flow of the water is expected to be approximately 180°C; the return flow is expected to be approximately 60°C.

3 **Water/air Heat Exchanger at SRF Dryer:** This heat exchanger will be situated within the SRF building and will provide 150°C hot air to the rotary SRF dryer. The system will allow the rate of airflow to be altered as necessary to control the drying process.

As indicated in the schematic drawing, the pumps for the hot water circuit circulation will be located within the SRF Building. The hot water system expansion tank will also be located within the landfill gas engine compound at the existing Drehid Waste Management Facility.

3. DESCRIPTION OF HEAT DELIVERY SYSTEM COMPONENTS

3.1. Air/Water Landfill Gas Engine Heat Exchanger System

The Exhaust Gas Heat Exchangers will use the exhaust gas to heat the circulated water to an approximate temperature of 180°C at an approximate pressure of 20bar. The exhaust gas will leave the engines at approximately 432°C and will be cooled down to approximately 180°C. With all four landfill gas engines on 100% load, a heat production of 2.4 MW is estimated. Approximately 1.8 MW will be needed to heat the inlet air to the SRF Dryer from an average ambient temperature of approximately 15 - 20°C to 150°C.

The main heat exchange system will include a bypass system on each engine to provide the first control measure of the temperature regulating process and to control the energy input into the hot water system and thereby avoid overheating. By switching one or more of the four engines to bypass, the heat input will be reduced in order to avoid overheating of the SRF drying process and the water system.

If more energy is needed for SRF drying (e.g. for higher SRF load – tonnage or moisture) and to extract additional heat from the landfill gas engines, a second set of heat exchangers will also be provided. These will pre-heat the return heating water by using the following components:

- Air intake cooler heat exchanger;
- Oil cooler heat exchanger;
- Engine cooling heat exchanger; and
- Generator cooling heat exchanger.

3.2. Heat Transfer Circulation Pipework (underground loop)

An underground pipework system, comprising a 50mm nominal diameter (DN50) steel welded pipeline with external insulation, laid in a single trench, will be used. The pipe diameter is designed to (a) minimise the quantity of water to be heated and also (b) minimise the heat losses through the pipe wall, by ensuring a high water velocity/flow rate through the pipe. Thermal expansion loops will be installed every 300m (estimated) as shown in the attached schematic drawing of the system.

Two circulating water pumps, rated to 20 bar, with one acting as a standby pump, will be installed within the SRF Building, close to the SRF dryer heat exchange unit. These pumps will be frequency controlled to form the second control measure to control the temperature of the system. By slowing down or speeding up the operating pump, the temperature of the air to the SRF dryer will be regulated. Higher water-flow will result in higher air temperatures. This control loop will feature a temperature instrument between the inlet air heat-exchanger and SRF dryer to control the flow of circulating hot water needed to achieve the 150°C air for the SRF drying process.

An expansion vessel will be installed in the pipework within the landfill gas engine compound and immediately downstream of the exhaust gas heat exchanger system. This vessel will allow for water expansion during the heating up process and also to ensure that sufficient water remains in the system at all times when cooling down.

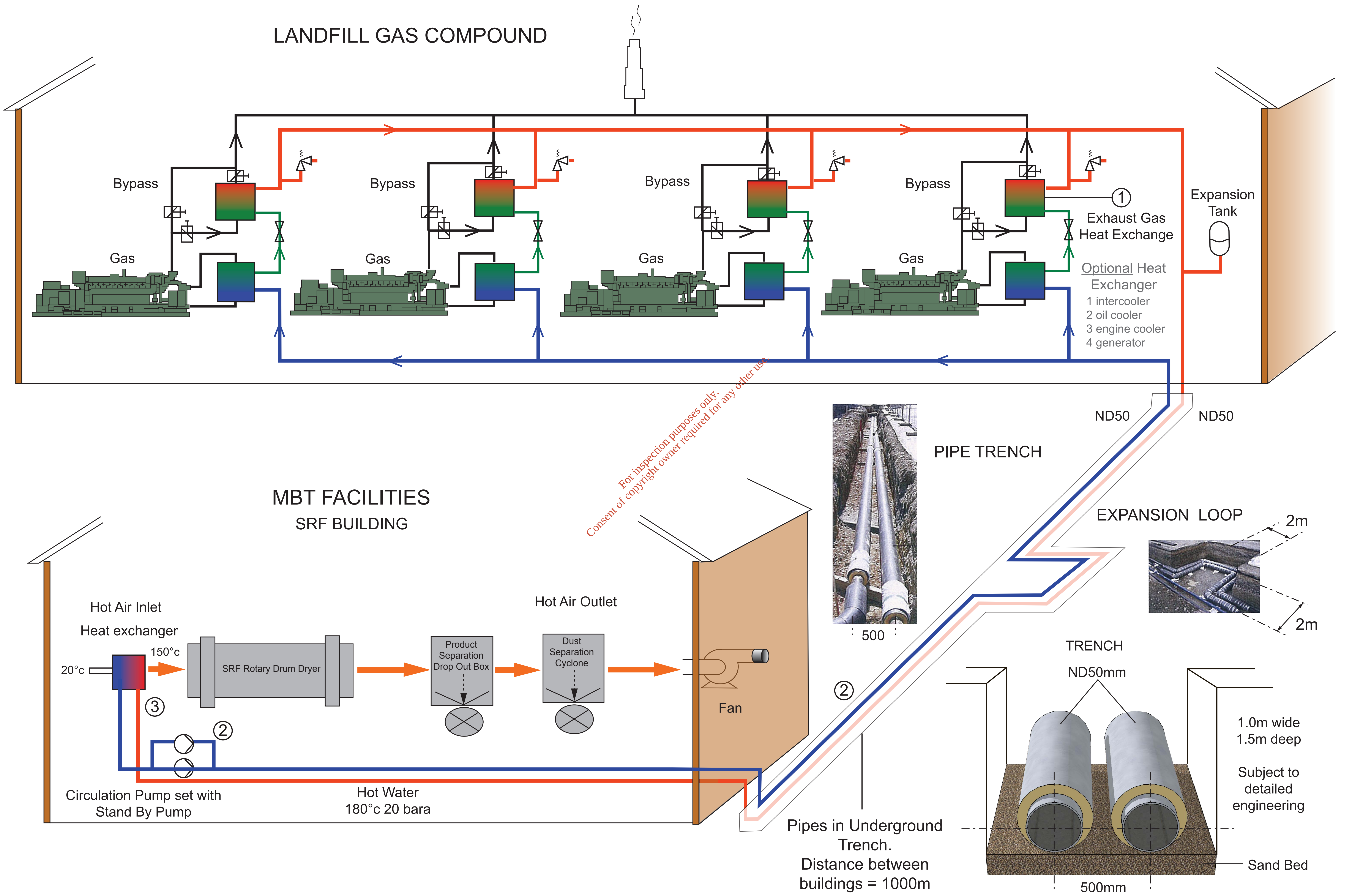
3.3. Water/Air Heat Exchanger at SRF Dryer

The inlet air, with an average temperature of approximately 15-20^{o}C, will be heated to 150^{o}C and then pulled through the SRF dryer.

The exhaust air from the SRF dryer will be mixed with air extracted from other MBT facility buildings and sent to the odour abatement system before discharge to atmosphere. This dilution with other process air will ensure that the temperature of the combined air is reduced to <40^{o}C to protect the microbial community within the odour abatement system.

The inlet air for the heat exchanger will be taken from inside the SRF Building to provide pre-heated air for this process. This will ensure efficient heat transfer and avoid low temperature winter air conditions which would have a negative impact on the performance of the system.

Furthermore, the amount of air transported through the water/air heat exchanger will be regulated by the frequency-controlled fan of the SRF-drying process which will form the third control measure of the heat delivery system.



LANDFILL GAS COMPOUND
Bypass
Bypass
Bypass
Bypass
Gas
Gas
Gas
Gas
1
Exhaust Gas Heat Exchange
Expansion Tank
Optional Heat Exchanger
1 intercooler
2 oil cooler
3 engine cooler
4 generator
ND50
ND50
PIPE TRENCH
500
EXPANSION LOOP
2m
2m
MBT FACILITIES
SRF BUILDING
Hot Air Inlet
Heat exchanger
Hot Air Outlet
150°c
20°c
SRF Rotary Drum Dryer
Product Separation Drop Out Box
Dust Separation Cyclone
Fan
3
2
2
Circulation Pump set with Stand By Pump
Hot Water
180°c 20 bara
TRENCH
ND50mm
1.0m wide
1.5m deep
Subject to detailed engineering
Sand Bed
500mm
Pipes in Underground Trench.
Distance between buildings = 1000m