REPORT

Waste Management Plan

Soil Remediation at Former Wellsite Unipkat I-22, Inuvialuit Settlement Region, Northwest Territories

Submitted to:

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Version and Review History

Rev	Date	Description	Author Name	Peer Review	PM Review	SME Review	Production Review	Senior Review
A	15 April 2025	Issued as Draft	Stephanie Villeneuve 25 February 2025	n/a	Brennan Vervoort 6 March 2025	Julia Krizan 10 March 2025	Kate De Castro 21 April 2025	Patrick Kalita 7 April 2025
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1.0 INTRODUCTION

1.1 Background

WSP Canada Inc. (WSP) has prepared this Waste Management Plan (the Plan) on behalf of Shell Canada Limited (Shell) to support the soil remediation at the former wellsite Unipkat I-22 (the Site) in the Inuvialuit Settlement Region (ISR), Northwest Territories (NWT) (the Project). The purpose of this Plan is to describe the proper treatment and disposal of several types of waste generated during the ice road construction, maintenance and use, remediation and transportation activities at the Site.

The Plan will be effective upon its approval and will be implemented during the Project. Paper copies of this Plan will be available on the Site (through the Site Supervisor) and will be posted at several accessible locations. All personnel will have access to paper and digital copies of the Plan.

1.2 Location and Description

The Site is approximately 115 kilometres (km) northwest of Inuvik, in the ISR in the Mackenzie Delta, NWT at latitude 69°11’36.07” N and longitude 135°20’33.88” W. The site location is presented in Figure A1 (Appendix A).

Access to the Site in winter will be via ice road extension from the Inuvik to Aklavik public ice road and snowpack ramp, as presented in Figure A2 (Appendix A). The ice road extension to the Site will pass through Inuvialuit 7(1)(A) Private Lands and will follow the Mackenzie River East Channel and Arvoknar Channel (Figure A2, Appendix A). Access to the Site in summer will be via barge, boat or helicopter.

Shell developed the Site as an exploratory natural gas well site in 1972 and 1973 and re-entered in 1996 for additional well abandonment activities. Historically, the Site consisted of a camp sump, a well centre (e.g., a historical well marker), a drilling waste sump, a drilling flare pit and wood pilings used to support surface infrastructure above the ground.

1.3 Project Summary

The scope of work for the Project consists of the following activities:

- Potential mobilization of a self-contained barge camp with select soil remediation equipment (e.g., soil treatment equipment, loaders, excavators etc.) stored on-board in late summer or early fall of 2025 (submitted under Environmental Impact Screening Committee [EISC] Registry File [04/25-18]) to be anchored at the Site and frozen-in and winterized for the winter field program that will use an ice road extension for access.
- Construction of an approximately 110 km long ice road extension from a junction approximately 30 km north along the Government of Northwest Territories (GNWT) Inuvik to Aklavik public ice road. This will allow site access for equipment as well as the off-site transport and disposal of waste materials. The ice road extension will cross Inuvialuit 7(1)(A) Private Lands and will follow the Mackenzie River East Channel and Arvoknar Channel (Figure A2, Appendix A). It is expected that ice road reconnaissance and profiling will begin in December 2025 and construction will be completed in February 2026. A snowpack ramp will be constructed at the Site to allow access for equipment and crew.
- Mobilization of remaining equipment (office trailer, including heated portable toilets, soil treatment equipment, skid steers, loaders, excavators, fuel trucks and fuel tanks, and other miscellaneous equipment) and self-

contained winter camp (if the barge camp was not mobilized and frozen-in at the Site) to the Site via the ice road for the duration of the winter season.

- Excavation and on-site thermal treatment of approximately 3,800 cubic metres (m^3) of soil containing petroleum hydrocarbons (PHCs) contaminants of concern (CoCs; PHC Fraction F2 and Type B Hydrocarbons) at concentrations above the proposed soil quality objectives (SQOs) at the Site using Enhanced Thermal Conduction (ETC). ETC involves transfer of a heated airstream (typically between 300 and 450 degrees Celsius [°C]) to volatilize and destroy PHCs in soil whose concentrations are above the proposed SQOs. To facilitate this, soil will be placed in treatment cells in which heat is applied via a dedicated air burner fueled by diesel. Prior to heating, the cell of soil is covered as a means of capturing the PHC vapour off-gas that is generated by the heating. Throughout the process, the generated PHC vapours will be channeled to a thermal oxidizer outside of the treatment cell for destruction prior to atmospheric release. The thermal oxidizer will be operated within defined parameters and monitored to ensure the efficient and complete destruction of PHC vapours. The proposed site layout and remedial extents are presented in Figure A3 (Appendix A).
- Excavation and off-site disposal of approximately 100 m^3 of soil containing barite (i.e., true total barium) at concentrations above the proposed SQOs, at an approved disposal facility.
- If remediation activities are completed during the winter of 2026, select equipment may be demobilized from the Site via the ice road prior to breakup. Some equipment may be secured on site or on the barge camp (potentially anchored at the Site) to be demobilized from the Site following 2026 spring breakup.
- Select equipment that was demobilized from the Site prior to breakup, and a barge camp (if a winter camp was used) will be re-mobilized by barge and boat to the Site in June 2026 to resume soil remediation, if required. If a barge camp was used during the winter of 2026 (potentially anchored at the Site), it will remain during breakup and re-open to continue operations for the summer of 2026, if required.
- If required, remedial activities, including ETC treatment, may resume during the summer and fall months of 2026.
- Installation of post-remedial groundwater monitoring wells and pre- and post-remedial thermistors (proposed locations in Figure A3, Appendix A) during the winter (pre-remedial) and summer/fall (post-remedial) months of 2026, including monitoring well sampling of existing and newly installed groundwater monitoring wells.
- Final demobilization by barge in the summer/fall of 2026, before freeze-up.
- Post-remedial groundwater and thermal monitoring, completed as day trips from Inuvik via boat or helicopter access, in the summer/fall of 2027.
- Removal of remaining wood pilings at the Site using the previously employed perimeter drilling method (EISC Registry File [10/22-01]) anticipated during a 2027/2028 winter field program.
- Fuel storage at the Site will be in appropriate fuel tanks and trucks for refueling of the equipment and ETC units, fuel storage and refueling areas will be bermed. Drip trays and secondary containment will be used at fuel storage and refueling areas.

1.4 Project Contacts

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1.5 Roles and Responsibilities

Shell is responsible for the overall content and assignment of responsibilities of this Plan. Shell's contractors are responsible for the implementation of this Plan and are expected to adhere to it. All personnel working on the Project, including Shell employees, contractors and consultants, will be made aware of this Plan.

1.6 Guidelines

This document was prepared using the following guidelines.

- Guideline for Hazardous Waste Management (Government of the Northwest Territories [GNWT] Environment and Natural Resources [ENR; now Environment and Climate Change] 2017);
- Guideline For Industrial Waste Discharges in the NWT (GNWT ENR 2004);
- Northern Land Use Guidelines: Camp and Support Facilities (GNWT Department of Lands [Lands, now Environment and Climate Change] 2015a);
- Northern Land Use Guidelines: Roads and Trails (GNWT Lands 2015b);
- Technical Document on Batch Waste Incineration (Environment Canada [now Environment and Climate Change Canada] 2010);

- Canada-Wide Standards for Dioxins and Furans (Canadian Council of Ministers of the Environment [CCME] 2001);
- Proposed NWT Air Regulatory Framework and the associated Technical Appendix (GNWT 2016); and
- Guidance for the Preparation of Waste Management Plans (Inuvialuit Water Board [IWB] 2014).

1.7 Actions to Reduce Wastes

This Plan incorporates the basic principles of waste management, which include source reduction, reuse, recycling/recovery, treatment, and disposal. Management of waste is an important consideration of Shell's operations. Where possible, every effort is made to minimize waste production by incorporating the principles of waste: Reduce, Reuse, Recycle and Recover.

- Source reduction includes the elimination or reduction of the volume or toxicity of waste by adopting practical methods such as using alternative materials or processes. This principle can be achieved by material elimination, inventory control and management, material substitution, process modification and improved housekeeping, maintenance and training.
- Reuse is achieved by using a product more than once for the same application or different purposes. Reusing materials such as fuel drums and pallets can reduce the amount of waste generated.
- Recycling/recovery of products that have one use reduces the volume of waste. Sorting products so they can be managed in bulk reduces the need for additional handling.
- Disposal of waste is considered the final option for waste management. When disposing of waste, the type of waste, volume, location and final containment must be considered. The waste disposal options available to this Project include approved off-site solid waste sites, municipal sewage lagoons and licensed hazardous waste disposal facilities.

2.0 IDENTIFICATION OF WASTE TYPES

All wastes will be identified, characterized and classified as hazardous or non-hazardous to develop safe and efficient handling strategies that assure regulatory compliance. This Plan will be distributed to all personnel and regular tailgate meetings will stress the importance of Shell's waste management principles and the duties associated with waste segregation. A summary of the anticipated waste streams and volumes is provided in Table A.

Table A: Anticipated Waste Streams During the Winter Stage of the Project

Category	Waste Stream	Description	Anticipated Volume
Non-hazardous waste	Non-recyclable domestic wastes (organic and non-organic)	Organic and non-organic waste including garbage, office garbage, camp waste and food scraps	Minimal amounts (e.g., less than 1 cubic metres [m^3] per week)
	Construction materials	Pieces of material such as metals and lumber	Less than 1 m^3 per week
	Cleared vegetation	Willows and brush may be cleared prior to remediation activities.	Limited to the required excavation areas, soil treatment cells and staging area.

Category	Waste Stream	Description	Anticipated Volume
	Recyclable domestic wastes	All material appropriate for recycling (i.e., beverage containers, tin cans, plastic and glass)	Less than 1 m^3 per week
Hazardous waste and sewage	Excavated soil from the remediation area	Contaminated soil resulting from remediation.	PHC-impacted soils to be treated on site and used as backfill. PHC-impacted soils that do not meet the treatment target for backfill will be disposed of off site. Volume to be determined during remediation and treatment. Barite impacted soils will be disposed of off site with an anticipated volume of 100 m^3.
	Contaminated soils and/or snow	Soil and/or snow contaminated with either diesel, oil or other accidental spill materials resulting from the Project	All efforts will be made to avoid spills
	Wood pilings	Treated wood piling with possible contaminated soils	Approximately 1.5 m^3/piling, estimated 118 piles remain
	Used hydrocarbon containers and absorbents	Containers used to store hydrocarbons and absorbent materials used for spill cleanup	All efforts will be made to avoid spills
	Waste oils	Used engine oils and oil filters	100 litres (L) per month
	Waste lead-acid batteries	Used batteries from equipment	6 per month
	Waste antifreeze	Used antifreeze from equipment	200 L per month
	Waste solvents	Solvents used to remove grease and oil from engine components and other machinery	10 L per month
	Camp sewage and greywater	From heated portable toilets (or equivalent) and the camp toilets, showers and kitchen facilities.	Maximum of 2 m^3 per day (depending on camp occupancy)

3.0 WASTE MANAGEMENT

3.1 Non-Hazardous (Domestic) Waste

Construction materials and other non-hazardous (domestic) waste will be stored temporarily at the Site inside the office trailer and/or inside the barge or winter camp (Figure A3, Appendix A) and will be transported at the end of each field season, at a minimum, to be disposed of at an approved landfill facility in Inuvik. The Inuvik Solid Waste Disposal Facility is aware of the upcoming domestic waste disposal requirements for the Project. Approval from the Town of Inuvik is provided in Appendix B. Estimated quantities for the various non-hazardous waste streams are provided above in Table A.

Cleared vegetation will be distributed away from the Site and a minimum of 30 metres from the Arvoknar Channel. It will be laid flat to encourage decomposition and/or mulched.

All personnel will be made aware of the recycling program and notes will be posted in the camp. Recyclable beverage containers will be collected in clearly labelled containers. Recyclables will be collected and transported to the bottle depot in the Town of Inuvik.

3.1.1 Combustible Non-Hazardous (Domestic) Waste

Pre-existing incinerator installed on-board the barge camp (i.e., the John Wurmlinger supplied by E. Grubens Transport Ltd. [EGT], or similar) may be used to incinerate non-hazardous (domestic), combustible, solid waste produced during the camp operations. On-board incineration will reduce the volume of non-hazardous waste that will otherwise be disposed of at an approved landfill (e.g., in Inuvik). All activities involved in the operation of the incinerator for the Project, including the collection of data for reporting purposes, will follow Environment Canada's Technical Document on Batch Waste Incineration (Environment Canada 2010), the Canada-Wide Standards for Dioxins and Furans (Canadian Council of Ministers of the Environment 2001) and the 2016 GNWT Proposed NWT Air Regulatory Framework - Technical Appendix. Incineration of non-hazardous, combustible waste will occur on-board the barge camp in a model CY-1020-FA incinerator (or similar) manufactured by Westland Environmental Services Inc. Information on the incinerator is provided in Appendix C. Table B summarizes technical data for the incinerator.

Table B: Key Design Parameters of Westland's Forced Air Incinerator (Model CY-1020-FA)

Air Blower Series Number	Burner Rating (1000 BTU/h)	Burner Rating (GJ/h)	Chamber Volume (m^3)	Capacity (kg/h)
AMU 400	500	0.53	0.57	64

Notes:
BTU/h = British Thermal Units per hour
GJ/h = Gigajoule per hour
Kg/h = Kilogram per hour

The incinerator will be used to dispose of non-hazardous, combustible waste, including food waste, paper and cardboard. No plastics, rubber, waste fuels/oils, material contaminated with fuels/oils or hazardous waste materials will be incinerated.

No incineration of waste will occur if a winter camp is used instead of a barge camp.

Incinerator Ash Testing and Disposal

All ash resulting from incineration will be securely bagged for temporary on-board storage. Prior to transport of incineration ashes, composite ash samples will be tested in a certified laboratory for leachable metals, dioxins and furans following the NWT Guidelines for Hazardous Waste Management (GNWT ENR 2017). Based on the test results, ash will be classified and then transported and disposed of accordingly, either at an approved landfill facility in Inuvik, with KBL Environmental Ltd. [KBL], or at Secure Energy's Fox Creek facility in Alberta. Approval from the Town of Inuvik, KBL and Secure Energy are provided in Appendix B. Final disposition will be determined by characterization data provided by the analytical laboratory.

MITIGATION MEASURES

The incineration process and the disposal of the ashes will follow all relevant regulations, outlined in the

Environment Canada 2010 Technical Document on Waste Batch Incineration, the Proposed NWT Air Regulatory Framework - Technical Appendix (GNWT 2016).

Mitigation measures designed to minimize potential adverse effects on air quality and the environment include the following:

- Emissions released to the atmosphere will be below thresholds set by the European Union and the Canada-wide Standards (for dioxins, furans and mercury) set be the Canadian Council of Ministers of the Environment in 2001.
- All ashes will be securely bagged, temporarily stored on-board, tested and then shipped and disposed of appropriately.
- Only non-hazardous, combustible, solid waste (paper and cardboard packaging, food wastes) will be incinerated. No other wastes or materials will be incinerated.
- The incinerator will be operated and maintained by trained camp personnel only. Training records will be kept.
- A waste incinerator operational and maintenance log will be kept for a minimum of three years (details are provided below under Training and Operation).
- Detailed records will be kept of weights, handling, test results and disposal of incinerator ashes.

TRAINING AND OPERATION

Waste segregation and storage will be supervised and prior to each incineration event, waste will be inspected and weighed. Operators will be trained in the following areas prior to incinerator operations:

- incinerator waste streams and load limitations;
- incinerator start-up and operating procedures;
- clean-out procedures and safe packaging of ashes;
- troubleshooting procedures;
- incinerator maintenance schedule; and
- record keeping and reporting.

As outlined in Environment Canada (2010), the typical incinerator operation follows these steps:

- The incinerator will be loaded with the appropriate camp waste and the burn cycle started.
- To confirm that the incinerator operates in the specified temperature range, the start cycle will be observed for at least 15 minutes after ignition. Notes will be taken, and adjustments made if required.
- When the incineration event is completed, and the unit has cooled, all ashes will be removed and bagged for subsequent laboratory testing and appropriate disposal.
- Any unburned materials found in the ashes will be added back into the incinerator for the next burn cycle.

- All incineration events will be reported in the incineration logbook, including (but not limited to): date and time, operator name, waste descriptions and weights, incineration start and end times, and burn temperature, and any other monitoring data as applicable.

Standard maintenance of the incinerator will ensure that the unit is working as per manufacturer's specifications and will meet emission guidelines as designed.

3.2 Hazardous Waste and Sewage

Soil that does not meet the SQO for PHCs following secondary treatment will be stockpiled for off-site disposal at an appropriately licensed solid waste management facility (e.g., KBL or Secure Energy's Fox Creek facility in Alberta) via winter road or barge, depending on quantity. Soils containing barite above the proposed SQOs will be excavated for off-site disposal at an approved facility outside the NWT.

Contaminated soil, snow and hydrocarbon absorbents from accidental Project spills will be handled according to the provided Spill Contingency Plan (Appendix E of the Project Description).

All hazardous waste will be properly packed in approved transport containers and shipped for final disposal to an appropriately licensed out of territory disposal facility. The NWT guidelines for the management of hazardous waste, which outline the registration and tracking requirements for generators, carriers and receivers of hazardous waste in the NWT, will be followed (GNWT ENR 2017).

Hazardous waste expected to be generated includes waste from general maintenance of heavy equipment and generators such as used grease, oil, filters, rags, used spill containment kits, and fluids from equipment such as hydraulic fluid, antifreeze and contaminated diesel. Hazardous waste will be stored in a locked seacan within a bermed area prior to appropriate disposal and/or re-use by contractors or being packaged in approved transport containers, manifested as per GNWT requirements and shipped to an approved out of territory disposal facility (e.g., KBL or Secure Energy's Fox Creek facility in Alberta). Written confirmation from KBL and Secure Energy of acceptance of hazardous materials is provided in Appendix B.

Grey water and sewage will be stored in the camp's holding tanks. Grey water and sewage will be securely transported for disposal at the licensed facility in Inuvik. The Inuvik Sewage Lagoon Facility is aware of the upcoming grey water and sewage disposal requirements for the Project. Approval from the Town of Inuvik is provided in Appendix B. Grey water and sewage will be removed on an as-needed basis, it is expected that removal will occur every month.

Solid waste generated from the wood pilings removal activities is expected to include a mix of wood piling debris and soil. It is estimated that the volume of waste generated by the wood pilings removal activities will be approximately 1.5 m^3/piling. It is estimated that approximately 118 piles remain at the Site. During the Project, the wood piling debris will be removed and transported to Inuvik for final off-site disposal at an appropriately licensed solid waste management facility (e.g., KBL or Secure Energy's Fox Creek facility in Alberta).

Estimated quantities for the various hazardous waste streams are provided above in Table A. The temporary on-site storage location for hazardous waste in a seacan inside the bermed fuel storage area is presented in Figure A3 (Appendix A).

4.0 TRAINING AND REPORTING

On-site personnel will receive basic waste management awareness training as part of their orientation. Personnel managing waste will be certified in Workplace Hazardous Material Information System and Transportation of Dangerous Goods.

Shell and its contractors are responsible for providing training to all employees and contractors. Waste management training will be provided to project staff prior to starting work, and will include the review of this Plan and information on:

- individuals' roles and responsibilities;
- identification of the various types of waste; and
- instructions on how waste streams are separated and managed.

A report detailing the types, volumes and final disposal locations of the Project-generated waste will be prepared and submitted to the applicable regulatory agencies.

5.0 REFERENCES

Literature Cited

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6.0 STATEMENT OF LIMITATIONS

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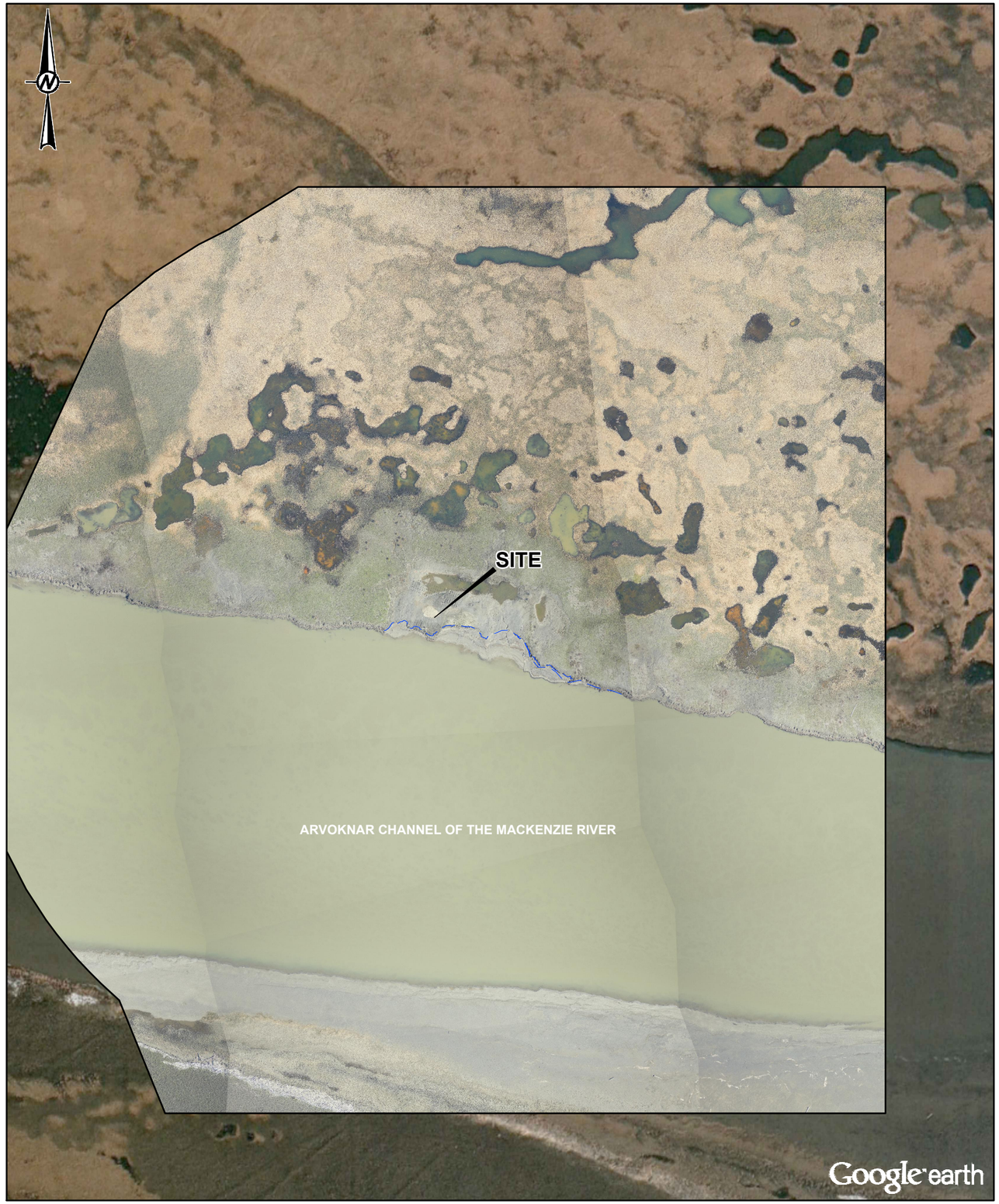
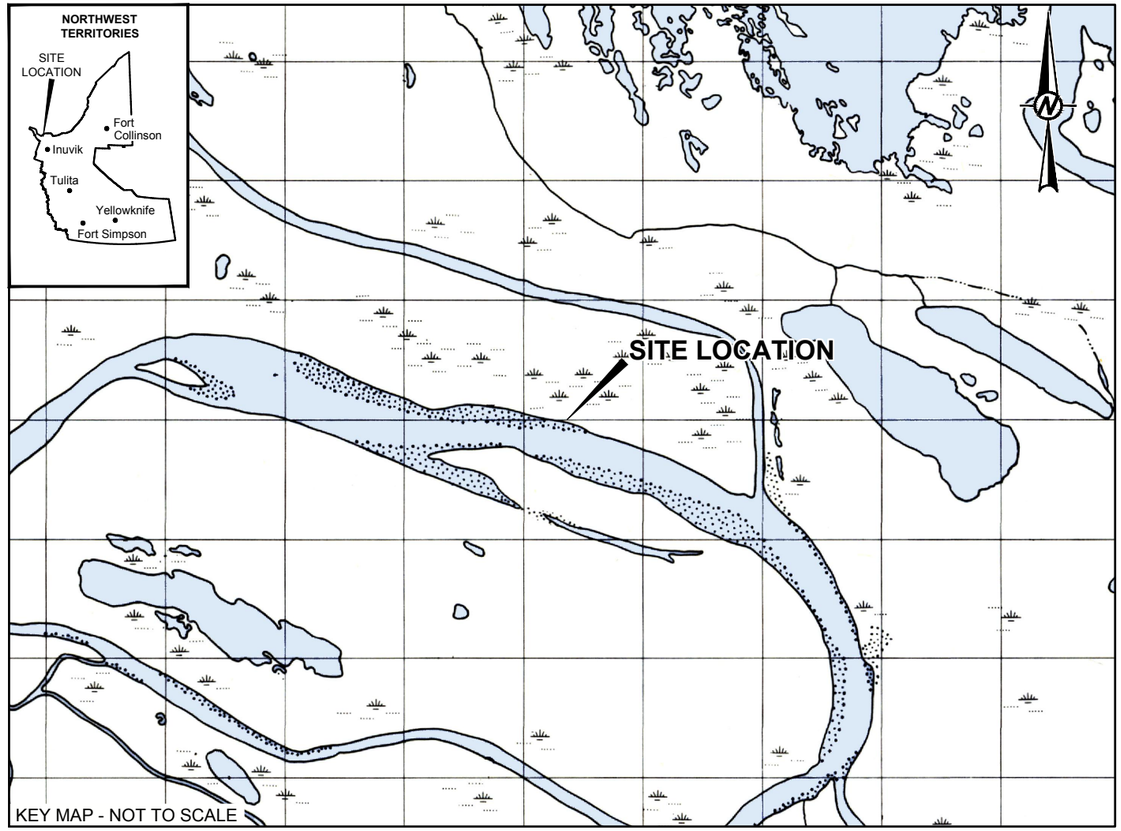
The factual data, interpretations, suggestions, recommendations, and opinions expressed in this document pertain to the specific project, site conditions, and are not applicable to any other project or site location. In order to properly understand the factual data, interpretations, suggestions, recommendations and opinions expressed in this document, reference must be made to the entire document.

APPENDIX A

Figures





LEGEND

2024 SHORELINE

REFERENCE

IMAGE OBTAINED FROM GOOGLE EARTH © 2024 GOOGLE INC. USED WITH PERMISSION. GOOGLE AND GOOGLE LOGO ARE REGISTERED TRADEMARKS OF GOOGLE INC.
IMAGERY DATE: 4 JUNE 2019. GOOGLE EARTH IMAGE IS NOT TO SCALE. DATUM: NAD83, PROJECTION: UTM ZONE 8.

TOPOGRAPHIC MAP 107C/04OBTAINED FROM Canmatrix. © 1958 THE ARMY SURVEY ESTABLISHMENT, R.C.E. PROJECTION: TRANSVERSE MERCATOR; DATUM: NAD27;
COORDINATE SYSTEM: UTM ZONE 8. TOPOGRAPHIC MAP HAS BEEN SHIFTED FROM NAD27 TO NAD83 FOR MAPPING PURPOSES.

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CLIENT
SHELL CANADA LIMITED

CONSULTANT
wsp

YYYY-MM-DD	2025-08-11
DESIGNED	SVilleneuve
PREPARED	APaull
REVIEWED	JKrizan
APPROVED	BVervoort

PROJECT
SOIL REMEDIATION
FORMER UNIPKAT I-22 WELLSITE
INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES

TITLE
SITE LOCATION PLAN

PROJECT NO.	PHASE-TASK	REV.	FIGURE
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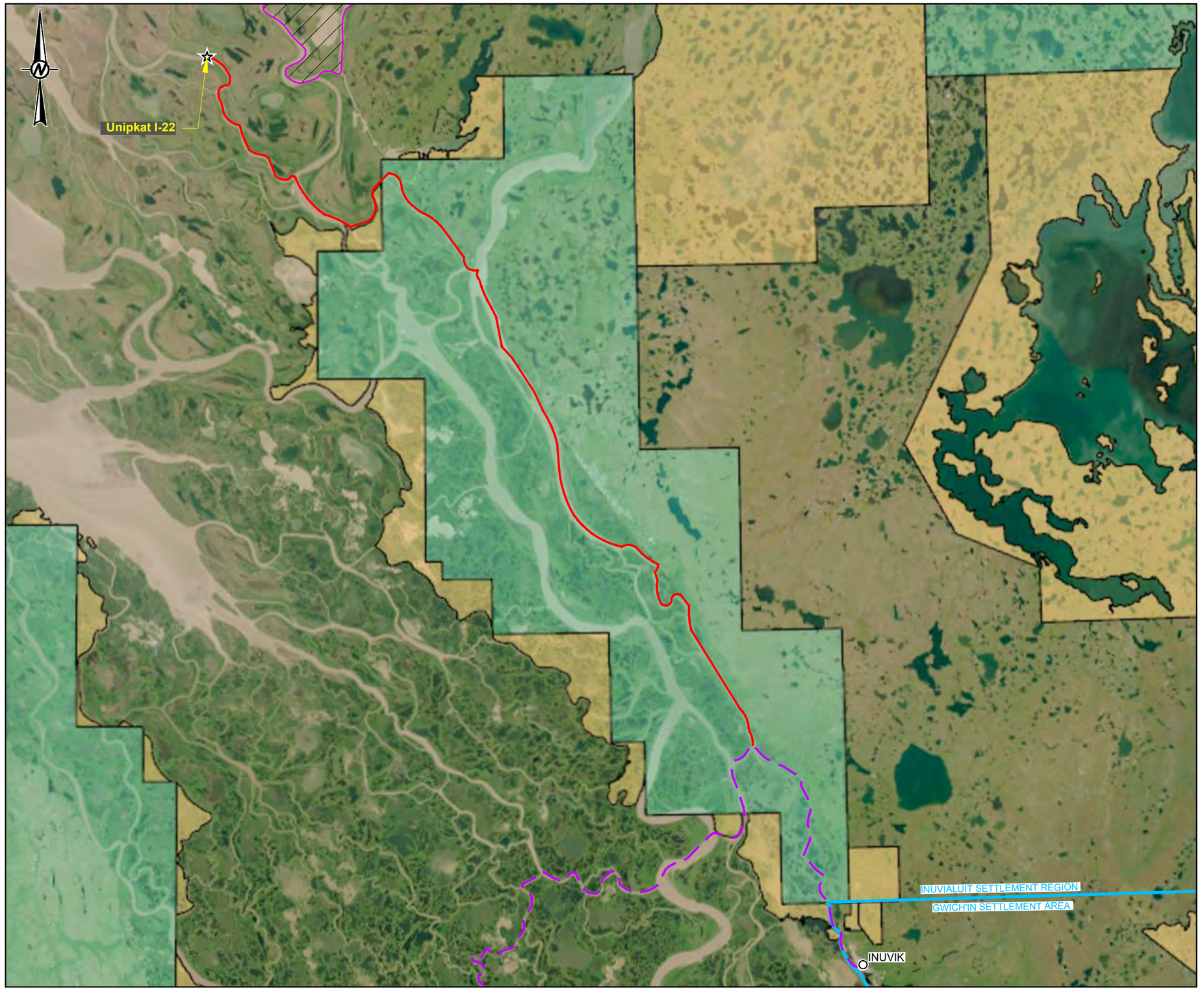

LEGEND

- SITE LOCATION
- CONSTRUCTED UNIPKAT I-22 ICE ROAD
- AKLAVIK ICE ROAD
- SETTLEMENT REGION BOUNDARY
- KENDALL ISLAND BIRD SANCTUARY

INUVIALUIT PRIVATE LANDS

- SURFACE TITLE
- SURFACE AND SUBSURFACE TITLE

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE - CANADA
2. BASE MAP: EARTHSTAR GEOGRAPHICS
3. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 8N

0 10 20
(APPROX.) KILOMETRES

CLIENT
SHELL CANADA LIMITED

PROJECT
SOIL REMEDIATION
FORMER UNIPKAT I-22 WELLSITE
INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES

TITLE
SITE LOCATION WITH PROPOSED ICE ROAD

CONSULTANT

YYYY-MM-DD	2025-05-07
DESIGNED	SVilleneuve
PREPARED	APaull
REVIEWED	JKrizan
APPROVED	PKalita

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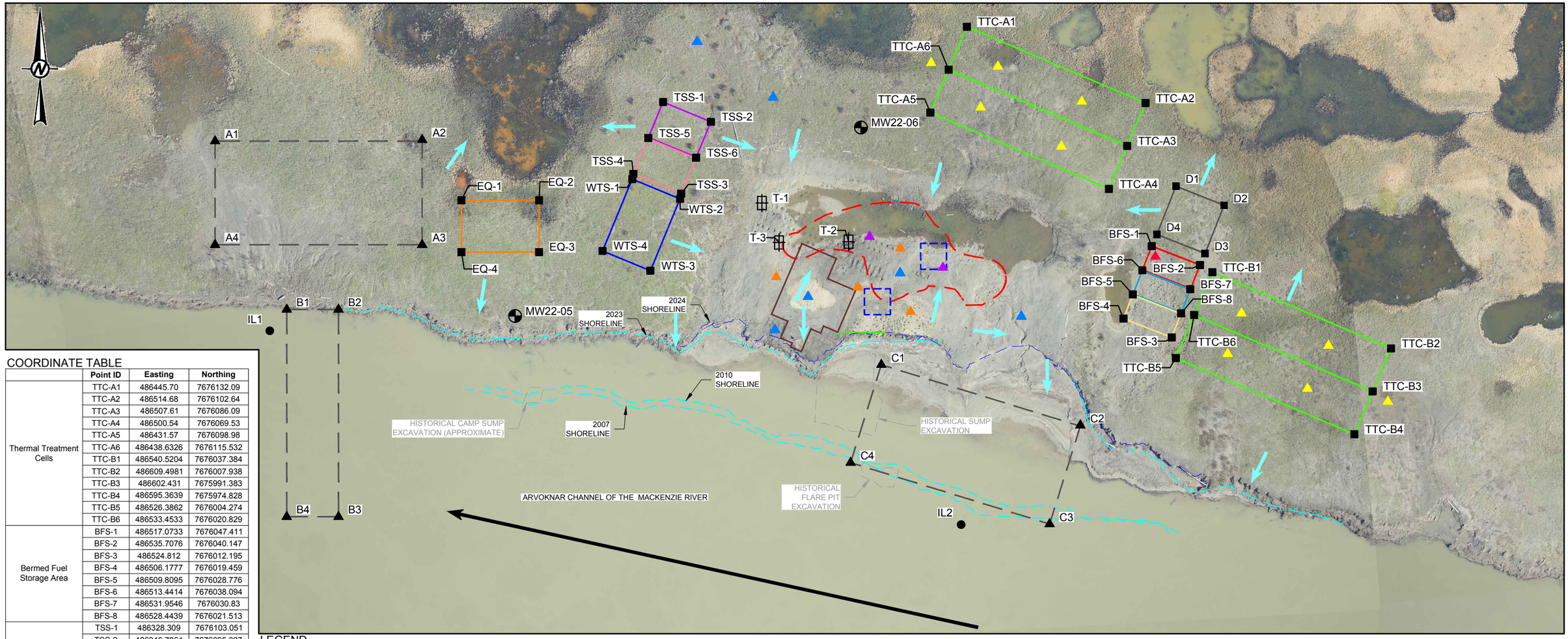

COORDINATE TABLE

	Point ID	Easting	Northing
Thermal Treatment Cells	TTC-A1	486445.70	7676132.09
	TTC-A2	486514.68	7676102.64
	TTC-A3	486507.61	7676086.09
	TTC-A4	486500.54	7676069.53
	TTC-A5	486431.57	7676098.98
	TTC-A6	486438.6326	7676115.532
	TTC-B1	486540.5204	7676037.384
	TTC-B2	486609.4981	7676007.938
	TTC-B3	486602.431	7675991.383
	TTC-B4	486595.3639	7675974.828
	TTC-B5	486526.3862	7676004.274
	TTC-B6	486533.4533	7676020.829
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	BFS-2	486535.7076	7676040.147
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	BFS-4	486506.1777	7676019.459
	BFS-5	486509.8095	7676028.776
	BFS-6	486513.4414	7676038.094
	BFS-7	486531.9546	7676030.83
	BFS-8	486528.4439	7676021.513
Temporary Soil Storage	TSS-1	486328.309	7676103.051
	TSS-2	486346.7864	7676095.397
	TSS-3	486335.305	7676067.681
	TSS-4	486316.8277	7676075.335
	TSS-5	486322.5684	7676089.193
	TSS-6	486341.0457	7676081.539
Activated Carbon Water Treatment System	WTS-1	486316.3993	7676073.299
	WTS-2	486334.8766	7676065.645
	WTS-3	486323.3953	7676037.929
	WTS-4	486304.9179	7676045.583
Equipment Lay Down Area	EQ-1	486250.4222	7676065.121
	EQ-2	486280.4222	7676065.121
	EQ-3	486280.4222	7676045.121
	EQ-4	486250.4222	7676045.121
Water Intake Locations	IL1	486176.3624	7676014.732
	IL2	486443.4605	7675939.946
Potential Locations of Land, Ice or Barge-based Camp	A1	486155.2446	7676087.94
	A2	486235.2446	7676088.475
	A3	486235.2446	7676047.94
	A4	486155.2446	7676047.94
	B1	486182.9283	7676022.999
	B2	486202.9283	7676022.999
	B3	486202.9283	7675942.999
	B4	486182.9283	7675942.999
	C1	486412.6244	7676001.643
	C2	486489.5093	7675978.281
	C3	486477.6255	7675940.178
	C4	486400.7407	7675963.871
Thermal Treatment Office/Control Center	D1	486526.4449	7676070.549
	D2	486545.0355	7676063.174
	D3	486537.6604	7676044.583
	D4	486519.07	7676051.96

LEGEND

- AREA OF REMAINING WOOD PILES
- EXCAVATION LIMITS (FORMER)
- SHORELINE
- OVERALL EXCAVATION EXTENTS FOR SOIL WITH PHC CONCENTRATIONS EXCEEDING SQOs FROM SURFACE TO 3.0 mbgs
- OVERALL EXCAVATION EXTENTS FOR SOIL WITH PHC CONCENTRATIONS EXCEEDING SQOs FROM SURFACE TO 1.5 mbgs
- POTENTIAL LOCATIONS OF LAND, ICE OR BARGE-BASED CAMP
- BERMED FUEL STORAGE
- BERMED HAZARDOUS WASTE STORAGE
- BERMED SOIL STORAGE FOR DISPOSAL
- EQUIPMENT PARKING / LAY DOWN AREA
- THERMAL TREATMENT CELLS
- ACTIVATED CARBON WATER TREATMENT SYSTEM AND TEMPORARY WATER STORAGE
- TEMPORARY SOIL STORAGE AREA (TREATED SOIL)
- TEMPORARY SOIL STORAGE AREA (UNTREATED SOIL)
- THERMAL TREATMENT OFFICE / CONTROL CENTER
- MONITORING WELL (EXISTING)
- THERMISTOR LOCATION
- WATER INTAKE LOCATIONS
- THERMISTOR TO MONITOR ETC TREATMENT CELLS
- POST-REMEDIAL GROUNDWATER MONITORING WELL
- PRE-REMEDIAL THERMISTOR
- POST-REMEDIAL THERMISTOR
- SPILL RESPONSE EQUIPMENT
- DIRECTION OF WATER CHANNEL FLOW
- DIRECTION OF SURFACE WATER FLOW

0 25 50
1:1,500 METRES

NOTES

1. ALL LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON ACTUAL FIELD CONDITIONS.
2. GPS COORDINATES PROJECTION: TRANSVERSE MERCATOR; DATUM: UTM83; COORDINATE SYSTEM: UTM ZONE 8.

REFERENCE

ORIGINAL DRAWING OBTAINED FROM CHALLENGER GEOMATICS LTD.; DWG No.: 22-35141-002; SCALE: 1:1,250; DATE: SEPTEMBER 12, 2022.

ADDITIONAL INFORMATION OBTAINED FROM IEG CONSULTANTS LTD.; PROJECT No.: A04025A02; SCALE 1:750; DATE: SEPTEMBER 20, 2011.

CLIENT
SHELL CANADA LIMITED

CONSULTANT
wsp

YYYY-MM-DD	2025-08-11
DESIGNED	SVilleneuve
PREPARED	APaull
REVIEWED	JKrizan
APPROVED	BVervoort

PROJECT
SOIL REMEDIATION
FORMER UNIPKAT I-22 WELLSITE
INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES

TITLE
PROPOSED SITE LAYOUT AND REMEDIAL EXTENTS FOR TYPE B PETROLEUM HYDROCARBONS AND BARITE (TRUE TOTAL BARIUM)

PROJECT NO.	PHASE-TASK	REV.	FIGURE
CA0042726.0037	1000-2403	1	A3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

APPENDIX B

Waste Disposal Approvals

SECURE MATERIAL APPROVAL FORM (LANDFILL)

LANDFILL NAME: Fox Creek East LF
FULL LSD: 02-06-062-18W5
Mat. App. #: FXCLF10002236-MA

SECURE

GENERATOR INFORMATION

GENERATOR'S FULL LEGAL NAME: SHELL CANADA LIMITED

REPRESENTATIVE'S NAME: Kyle Thompson PHONE: (403) 801-6438

EMAIL: kyle.thompson@shell.com

THIRD PARTY REPRESENTATIVE INFORMATION

THIRD PARTY'S FULL LEGAL NAME: WSP CANADA INC PHONE: (613) 683-9031

REPRESENTATIVE'S NAME: Brennan Vervoort EMAIL: brennan.veroort@wsp.com

CUSTOMER BILLING INFORMATION

BILL TO CUSTOMER: WSP Canada Inc. PHONE: (000) 000-0000

BILLING CONTACT: Accounts Payable-Calgary-237 4 EMAIL: gld.canadaaccountspayableinvoices@wsp.com

BILLING ADDRESS: 237 4 Ave SW #3300, Calgary, T9E 0Z4, AB, Canada

TRUCKING INFORMATION

COMPANY: E. Gruben's Transport Ltd. TENORM HAULER PERMIT #:

PRODUCT INFORMATION

SOURCE LOCATION PRODUCT IS RECEIVED FROM: 69°11'36.07" N 135°20'33.88"W - UNIPKAT I-22

HAZARDOUS: NO

DOWNHOLE / SURFACE: Pit

ANALYTICAL EXPIRY DATE: 08/15/2026

WASTE DESCRIPTION: Contaminated Debris and Soil (crude oil/conde

DISPOSAL UNITS: Tonnes

RIG #:

WASTE GENERATOR CERTIFICATION

Through submission of a SECURE Application Form (SAF) the generator or the generator's authorized representative has certified that the waste has been classified in accordance with the applicable legislation and it is suitable for disposal at the approving landfill. Ultimate acceptance of the waste will be subject to further screening by SECURE at the destination landfill. SECURE is to be notified by the generator or the generator's representative if the nature of the waste changes.

SECURE REPRESENTATIVE

DATE: August 20, 2025 NAME: Brianne Humphries

SIGNATURE: TITLE:

From: Barron, Ali
To: Villeneuve, Stephanie
Subject: FW: Waste approval question
Date: August 26, 2025 6:58:23 PM
Attachments: image002.png
image003.png

FYI

From: Chris Herbert <cherbert@secure.ca>
Sent: August 26, 2025 3:57 PM
To: Barron, Ali <Ali.Barron@wsp.com>; Administrator, Fox Creek East LF <foxcreekeastlfadmin@secure.ca>
Subject: Re: Waste approval question

Ali
The contents of this are part of the remediation.
I think it could fall under the already approved SAF.

Thanks

Chris Herbert
Area Sales Manager, Central

C: 780-778-1737

24H Service: 780-225-2000

CHERBERT@SECURE.CA

From: Barron, Ali <Ali.Barron@wsp.com>
Sent: Tuesday, August 26, 2025 3:43:22 PM
To: Chris Herbert <cherbert@secure.ca>; Administrator, Fox Creek East LF <foxcreekeastlfadmin@secure.ca>
Subject: FW: Waste approval question

Hello, just following up on this one, I don't think I have seen a reply.

Thanks,
Ali

From: Barron, Ali
Sent: August 22, 2025 3:03 PM
To: Chris Herbert <cherbert@secure.ca>; Administrator, Fox Creek East LF <foxcreekeastlfadmin@secure.ca>
Subject: RE: Waste approval question

Hello,

Please see the attached form and let me know if you have any questions or comments.

Thanks,
Ali

From: Chris Herbert <cherbert@secure.ca>
Sent: August 22, 2025 1:57 PM
To: Barron, Ali <Ali.Barron@wsp.com>; Administrator, Fox Creek East LF <foxcreekeastlfadmin@secure.ca>
Subject: Re: Waste approval question

Ali
The easiest way is to send in an SAF for the different types of waste (soil and pads, pipes) and if there is anything else.

Chris Herbert
Area Sales Manager, Central

C: 780-778-1737

24H Service: 780-225-2000

CHERBERT@SECURE.CA

From: Barron, Ali <Ali.Barron@wsp.com>
Sent: Friday, August 22, 2025 1:01:39 PM
To: Administrator, Fox Creek East LF <foxcreekeastlfadmin@secure.ca>; Chris Herbert <cherbert@secure.ca>
Subject: Waste approval question

Hello,

I am looking to get approval for some miscellaneous waste that we may produce during our upcoming winter program. Likely would include used hydrocarbon absorbent pads/boom (from spill clean up). As well as plastic piping and polyethylene sheets, all with potential residual petroleum hydrocarbons. This is based on what we have disposed of on other projects in the area.

Are you able to provide a general acceptance letter for things like this or should I complete a SAF and then guestimate quantities?

Please let me know what you think.

Thanks,

Ali Barron
Environmental Project Coordinator

T +1 780-930-5492
M +1 403-542-2518

-LAEmHhHzdJzBITWfa4Hgs7pbKI

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Disclaimer: This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error please notify the system manager. Please note that any views or opinions presented in this email are solely those of the author and do not necessarily represent those of the company. Finally, the recipient should check this email and any attachments for the presence of viruses. The company

accepts no liability for any damages caused by any viruses transmitted by this email.

QUOTE #: QWH-2501-0087

Date: March 21, 2025

WSP
237 4th Ave SW Floors 30-33
Calgary, AB T2P 4K3

Attention:
Ali Barron
Project Coordinator
1-403-542-2518
Ali.barron@wsp.com

RE: Waste Disposal Pricing
Site: Shell Inuvik, NT

Thank you for contacting KBL Environmental Ltd. for your waste disposal needs. Please see below for summary of services and your disposal pricing as discussed.

On behalf of KBL Environmental., I look forward to working with WSP to assist you in handling all your waste management needs.

KBL Environmental Ltd. can accept all waste streams and criteria that are listed in the waste disposal table on page 2 of quote # QWH-2501-0087. However, if the criteria is above Alberta Class 2 Landfill detectable limit, waste profiles and characteristic samples will need to be generated to classify the waste and find an approved disposal vender that can accept the waste under the new conditions.

Yours Truly,
Rob Bond
Facility Manager
780-918-7684
rbond@kbl.ca

Waste Disposal

Description	Waste Code	UOM	# of Units	Rate
Waste Non-Regulated Solids (Soil c/w Hydrocarbons) **Class II Landfill Criteria Acceptance**	MBSC WH	Mega Bag	01	$400.00
Waste Non-Regulated Liquids (Water c/w Hydrocarbons)	DRWC WH	Drum	01	$180.00
Waste Non-Regulated Liquids (Water c/w Hydrocarbons)	TOWC WH	Tote	01	$595.00
Waste Leachable Liquids (Used Oil, Glycol & Water)	DRWL M	Drum	01	$205.00
Waste Leachable Liquids (Used Oil, Glycol & Water)	TOWL M	Tote	01	$600.00

Supplies

Description	UOM	# of Units	Rate
Self-standing Mega Bag - Lined	Mega Bag	01	$55.00
Steel Drum – Open Top	Drum	01	$130.00
Tote – Used tote	Tote	01	$200.00

Transportation

Description	UOM	# of Units	Rate
3rd Party Transportation	Trip	01	$16,500.00

Terms, Conditions and Notes:

1. All pricing is in Canadian Funds
2. Pricing above does not include GST.
3. As of May 1, 2024, KBL Environmental has implemented an Environmental Recovery Fee (ERF). ERF is currently set at 7% and is subject to change.
4. All pricing is subject to verification (SDS, analytical or other testing as required) or waste profile approval. If waste does not meet criteria, pricing is subject to change.
5. Quantities are estimated, actuals will be billed based on the pricing listed above.

Quote Acceptance

Implementation
Upon your approval of this quotation, please sign the quotation acceptance and submit back with quote.

☐ I accept the above quotation
☐ I do not accept the above quotation

Company: WSP

Name: Ali Barron

Signature: _____

Date: _____

PO#: _____

If there is any special billing instructions (portals, emails, etc), please specify below space:

_____

_____

_____

_____

_____

From: Lloyd Gruben
To: Mclean, Scott (Applied Solutions)
Subject: RE: Unipkat Waste Disposal
Date: February 26, 2025 9:15:14 AM
Attachments: image001.png

Hi,
Only incinerate non hazardouss material.

From: Mclean, Scott (Applied Solutions) <scott.mclean@wsp.com>
Sent: February 25, 2025 11:07 AM
To: Lloyd Gruben <Lloyd_Gruben@gov.nt.ca>
Subject: RE: Unipkat Waste Disposal

Thanks Lloyd,

And non-hazardous waste can go into the Inuvik landfill? The plan is to incinerate most of the non-hazardous waste and dispose of the ash accordingly but there may be a small amount of waste not incinerated.

Scott McLean, P.Eng, PMP
Lead Project Manager

M +1 604-679-5538

From: Lloyd Gruben <Lloyd_Gruben@gov.nt.ca>
Sent: February 25, 2025 8:23 AM
To: Mclean, Scott (Applied Solutions) <scott.mclean@wsp.com>
Subject: RE: Unipkat Waste Disposal

Morning,
Answer is yes. Sewage and grey water can be disposed at the Inuvik sewage/grey water lagoon.

From: Mclean, Scott (Applied Solutions) <scott.mclean@wsp.com>
Sent: February 24, 2025 11:07 AM
To: Lloyd Gruben <Lloyd_Gruben@gov.nt.ca>
Subject: Unipkat Waste Disposal

Hi Lloyd,

We are working on regulatory submittals for remediation of Shell's Unipkat site that I imagine you are familiar with (if not, no worries, let me know and I will pull up some information for you). As part of these submittals, we require acceptance from all of our waste disposal facilities. Can you please let me know if we will be able to dispose of non-hazardous waste as well as sewage/grey water in the Inuvik disposal facilities? This would go through EGT/NWI in the same manner of the West Channel project. I expect volumes to be similar to West Channel as we will have around 30 people at Unipkat as well.

Thanks,

Scott McLean, P.Eng, PMP
Lead Project Manager

M +1 604-679-5538

WSP
Suite 700, Landmark 6, 1631 Dickson Avenue
Kelowna, BC
V1Y 0B5 Canada

wsp.com

-LAEmHhHzdJzBITWfa4Hgs7pbKI

TOWN OF INUVIK
2 FIRTH ST, PO BOX 1160
INUVIK NT X0E 0T0

P 867.777.8600
F 867.777.8601
WWW.INUVIK.CA

July 29, 2025

Shell Canada Limited
Suite 4000, 500 Centre Street SE
Calgary, Alberta T2G 1A6

Attention: Ms. Stephanie Villeneuve

Re: Use of Sewage and Solid Waste Dumping Facilities for Soil Remediation at the Former Unipkat I-22 Wellsite, Water Licence Application N5L8-1848 - Shell Canada Limited

Ms. Villeneuve:

Please be advised that the Town of Inuvik acknowledges that Shell Canada Limited and their Prime Contractor, WSP Canada Inc. (WSP), may use the above-mentioned facilities in conjunction with the Unipkat I-22 Water License Application (N5L8-1848). As part of this approval WSP or any contractor working on their behalf has acknowledged that there will be a fee for use of these facilities. In addition, they shall inform the Town of Inuvik Director of Public Services when they are to make use of the sewage dumping facility and report the volume of sewage brought in from this project.

The Town will accept in principle the above-mentioned products provided they follow the guidelines and fees as set out in the various Town of Inuvik by-laws. All the waste must be domestic use type only. None of it shall contain any drilling or industrial type waste.

We are required as part of our water license to account for these types of additional wastes entering our sewage lagoon and solid waste site, respectively.

If you have any questions or concerns, please do not hesitate to contact me. Thank-you in advance for your cooperation.

Regards

Town of Inuvik
Cythia Pihlaja
Senior Administrative Officer

CC: Rick Campbell – Town of Inuvik – Director of Public Services

APPENDIX C

Incinerator Manual

Forced Air Incineration Systems

Operating and Maintenance Manual

Westland Environmental Services Inc.
20204 110 Ave. NW
Edmonton, Alberta
Canada T5S 1X8
780 447 5052
info@westlandenvironmental.com

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

Thank you for selecting Westland Environmental Services Inc. (Westland) to provide you with a reliable, proven and cost-effective system to manage your waste in an environmentally sound manner. This manual has been prepared to allow you to operate and maintain the system safely and efficiently, thereby ensuring its proper operation and continued use for a long period of time.

It also contains information on the combustion process. We believe that understanding the basic principles would make you knowledgeable, and hence a better operator. Table 1 outlines the contents of this manual.

Table 1 Organization of Manual

Chapter Number	Title Brief Description
2	**Principles of waste incineration** What incineration or combustion process is, why waste is incinerated and the components of a waste, including heating value, and how waste properties affect the incinerator capacity.
3	**System Description** The components of both the single-chamber and dual chamber designs and their functions are described
4	**Operation and Maintenance** How to operate and maintain the system, including safety equipment to be used.
5	**Warranty** Terms of the warranty

2 PRINCIPLES OF WASTE INCINERATION

2.1 Combustion

Combustion, burning, incineration, and thermal oxidation all denote the same process, which is the reaction of a "combustible" matter with oxygen that occurs at temperatures higher than the ignition temperature [1] of that matter. The reaction is exothermic, meaning that it generates heat in the form of hot gas.

In the case of waste, it may also contain non-combustible matter which does not react with oxygen. In waste incineration, the non-combustible component ends up as ash and a small portion of it is also present in the hot gas in the form of particulate matter or dust.

[1] Below the ignition temperature combustion does not take place. Consider, for example, gasoline or wood: it has to be "ignited" for combustion to take place. That is, the temperature in some portion of the matter must be brought up to the ignition temperature for combustion to start..

Figure 1 shows schematically the process of waste incineration. The oxygen used comes from air, which contains 21% of oxygen by volume, and the hot gas is typically referred to as flue gas.

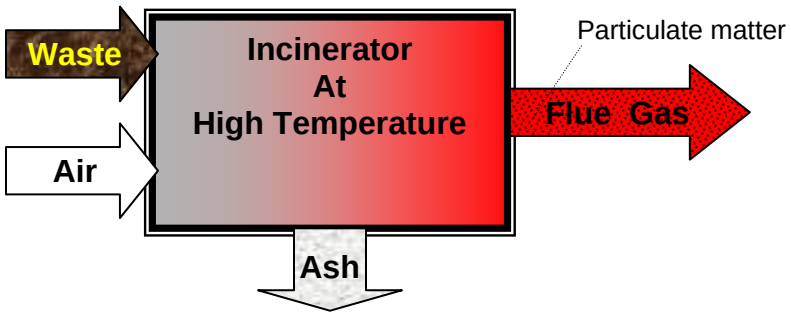


Figure 1 Schematic Diagram of Incineration Process

2.2 Why incinerate waste ?

The main purpose is to reduce the mass and volume for final disposal. Another important reason, since the waste may contain pathogenic, infectious or toxic materials, is to "detoxify" it. And in remote areas where wildlife is present, scavenging can be prevented by incineration.

In some cases, incineration is used to recover the energy contained in the waste in the form of electricity, steam, hot fluids or hot air. And in other cases, valuable materials can be recovered from the ash, or the ash as a whole can be used for soil amendment or as a construction material.

2.3 Waste components

There are different ways of characterizing waste, depending on the purpose for doing it. Here, it is sufficient to characterize the components as follows: [2]

A. Water is an important component because in incineration it has to be evaporated, which requires a lot of energy, [3] which in turn, has the effect of lowering the temperature of the flue gas.

B. Combustible is the component that reacts with oxygen and releases heat in the process. [4] The higher the combustible content in the waste the more air per kg of waste is needed for incineration.

This component can be further classified as:

---

[2] This is referred to as proximate analysis. Another method is elemental analysis, which produces the elemental composition (C, H, O, N, S, Cl …) of the waste.

[3] It takes ~ 2.3 MJ (2200 BTU or 90 cc of propane or 60 cc of diesel) to evaporate 1 L or 1 kg of water. This is referred to as the latent heat of evaporation.

[4] The term "organic" is also used, which is strictly incorrect in that some "inorganic" elements or compounds are combustible, such as carbon, sulphur and carbon monoxide.

(i) Volatile, which is released to the gas phase when the combustible matter is heated without the presence of oxygen, and

(ii) Fixed carbon which remains in the solid waste after the volatile has been released. This is often referred to as charcoal.

C. Non-combustible is the component that does not react with oxygen. [5] As previously mentioned, this forms ash, and some of it is entrained in the flue gas in the form of particulate matter or dust. The higher the non-combustible content in the waste, the less quantity of waste that can be incinerated without removing ash from the combustion chamber. Note also if the waste contains metals, such as lead and cadmium, these metals will be present in the ash as well as in the particulate matter.

2.4 Heating Value

Heating value, calorific value and heat of combustion are synonyms that quantify the heat released by the combustible component in the waste upon complete combustion. An understanding of the concept can be gained from the hypothetical processes shown in Figure 2.

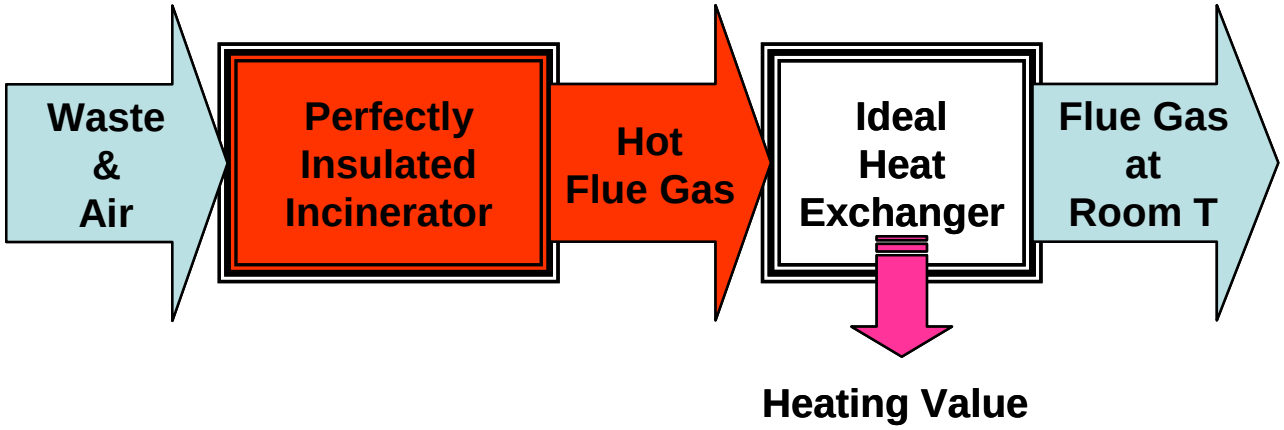


Figure 2 The Concept of Heating Value

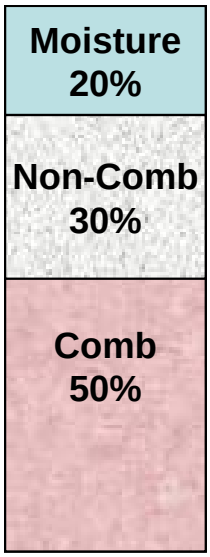
A measured mass of dry waste and a sufficient amount of oxygen , at room temperature, are ignited, and the resulting hot flue gas is passed through a heat exchanger, where heat is extracted until the flue gas is brought back to room temperature. Let M be the mass (kg) of the dry waste fed, and H (MJ) the heat extracted from the heat exchanger. The heating value of the dry waste is H/M (MJ/kg).

[5] The terms "ash" and "inorganic" are also used. Note that the latter is inaccurate as explained previously.

2.5 Different Expressions for Heating Value

Two different values are reported in the literature (a) "high" or "gross", and (b) "low" or "net". The former corresponds to the case where the moisture in the flue gas is condensed, and hence the high or gross heating value *includes* the latent heat of evaporation of the water formed in combustion (see Footnote 3). The latter excludes the latent heat evaporation. The low or net heating value thus represents the maximum available energy that can be recovered from the flue gas without condensation.

To be noted also is the basis on which the heating value is expressed, which can be (a) as fired, (b) dry basis or (c) ash free. The distinction is illustrated in Figure 3. An understanding of the different bases can be gained by noting that heating value is a property of the combustible component in the waste. Water and the non-combustible component simply "dilute" the heating value. In terms of incinerator operation, the relevant basis is "as fired".



*** HV as measured:**
15 MJ/kg "Dry Basis"

*** HV of whole waste:**
= (30 + 50)/100 * 15 = 12 MJ/kg "As Fired"

• HV of combustible component:
= (30 + 50)/50 * 15 = 24 MJ/kg "Ash Free"

Figure 3 Different Bases for Expressing Heating Value (HV)

2.6 Examples of waste characteristics

Approximate compositions and heating values of commonly found wastes are given in Table 2.

Table 2 Classification and Properties of Common Wastes

Type*	Description	Components	Weight %			MJ/kg
			Moist	Comb	Non-C	HHV (A/F)
0	Trash	Paper, cardboard, cartons wood boxes and combustible floor sweepings from commercial and industrial activities. Up to 10% by weight of plastic bags, coated paper, laminated paper, treated corrugated cardboard, oily rags and plastic or rubber scraps.	10%	85%	5%	19.7
I	Rubbish	Trash + Type 3 (up to 20%)	25%	65%	10%	15
2	Refuse	Rubbish and Garbage	50%	43%	7%	10
3	Garbage	Animal and vegetable wastes, restaurants, hotels, markets, institutional, commercial and club sources	70%	25%	5%	5.8
4	Animal/ Pathological	Carcasses, organs, hospital and laboratory abbatoit, animal pound, veterinary sources	85	10	5	2.3

Notes:
Moist = moisture, Comb = Combustible, Non-C = Non-combustible, HHV = High Heating Value, A/F = As Fired
* In some cases Roman numerals are used. That is Types 0, I, II, III and IV

2.7 Incinerator Capacity and Load Size

Incinerator capacity is dependent on waste composition. In general, the higher the heating value, the lower is the capacity in terms of kg/h that can be incinerated. This can be explained by noting that a waste that has a higher heating value requires more air per unit mass than that required to incinerate a waste with a lower heating value. To put it another way, for the same amount of air, more mass of a waste with a lower heating value can be incinerated.

Another important consideration is the size of the batch loaded to the incinerator. The higher the heating value, the smaller (lighter) the load should be. Otherwise, insufficient amount of air would generate black smoke.

Unfortunately, waste composition is not always known. Nevertheless there may be indications of the components present. To assist in getting a qualitative estimate of the heating value of a batch of waste, the heating values of common "generic" waste components are shown in Table 3.

Table 3 High Heating Values (Approximate) of Common Waste Components

Component	MJ/kg A/F *	Component	MJ/kg A/F *
Kerosene, Diesel …	44	Leather	16
Plastics	46	Wax paraffin	44
Rubber, Latex	23	Rags (linen, cotton)	17
Wood	18	Animal fats	39
Paper	17	Citrus rinds	4
Agricultural waste	17	Linoleum	25

* A/F: As Fired

Another important waste component is the volatile content in the waste. Table 4 shows the proximate components of various materials and wastes.

In general, this component is responsible for smoke generation. Therefore, as in the case with heating value, the higher the volatile content, the smaller the load that should be charged to the incinerator.

Table 4 Proximate Composition of Various Materials

Material	Volatile	Moisture	FC	Ash	FC/V
	%wt	%wt	%wt	%wt	-
Coal (bit.)	30	5	45	20	1.5
Peat	65	7	20	8	0.3
Wood	85	6	8	1	0.1
Paper	75	4	11	10	0.15
Sewage sludge	30	5	20	45	0.66
MSW	33	40	7	20	0.21
RDF	60	20	8	12	0.13
PDF	73	1	3	13	0.04
TDF	65	2	30	3	0.46
PE,PP,PS	100	0	0	0	0
Plastics + Colour	98	0	0	2	0
PVC	93	0	7	0	0.08

Notes: FC = Fixed Carbon; FC/V: Ratio of Fixed Carbon to Volatile

3 SYSTEM DESCRIPTION

3.1 Different Models

Westland's forced air incinerators are of two types:

- Single-chamber, referred to as the Primary Chamber; and
- Dual-chamber, which has an additional Secondary Chamber.

The term forced air denotes the use of one blower or two blowers to "force" combustion air into the combustion chamber(s).

Different sizes are produced, and the auxiliary fuel can be diesel, propane or natural gas, as specified by the user. Key design parameters of the different models are summarized in Table 5.

The combustion air blower characteristics are shown in Table 6. [6] Beckett's Oil Burner model SF is used when diesel is the auxiliary fuel. [7] When propane or natural gas is used, a Midco Incinomite burner is used. [8] The information sheets and manuals can be found in Appendix A: Information sheets and Manuals for Burners and Blowers.

3.2 System components

Regardless of the model of your incinerator, the components are similar. Figure 4 shows a schematic diagram of the dual-chamber design. If your incinerator is single-chamber,

[6] http://www.eccohtg.com/links/Product%20Listing/Ventilation%20Products/Miscellaneous%20Fans.pdf

[7] http://www.beckettcorp.com/res2.htm

[8] http://www.midcointernational.com/products/incinomite/

then ignore the Secondary Chamber and the associated burner and blower. Figure 5 and Figure 6 show photographs of the Single-Chamber (CY-1050-FA) and Dual-Chamber (CY-2050-FA) designs, respectively. Table 7 summarizes the components and their functions.

Table 5 Key Design Parameters of Westland's Forced Air Incinerators

Model	Air Blower Series No.	Burner Rating		PC Volume		Capacity (Type 0, 1, 2, 3 Waste)	
		1000 Btu/h	GJ/h	ft^3	m^3	lb/h	kg/h
CY-1013-FA	AMU 400	325	0.34	13	0.37	90	40
CY-1020-FA	AMU 400	500	0.53	20	0.57	140	64
CY-1050-FA	AMU 400	700	0.73	50	1.4	200	90
CY-2020-FA	PC: AMU 400 SC: AMU 245	PC: 490 SC: 280	PC: 0.51 SC: 0.29	20	0.57	140	64
CY-2050-FA	PC: AMU 625 SC: AMU 225	PC: 700 SC: 280	PC: 0.73 SC: 0.29	50	1.4	200	90

Notes: PC: Primary Chamber; SC: Secondary Chamber. See Table 2 for waste properties

Table 6 Combustion Air Blowers Characteristics

MODEL	HP	RPM	AIR DELIVERY (CFM AT R.P.M. SPECIFIED)							
			Free Air	1/8" SP	1/4" SP	3/8" SP	1/2" SP	3/4" SP	1" SP	1-1/4" SP
AMU-75	1/60	3000	75	61	54	43	–	–	–	–
AMU-130	1/70	1550	130	107	87	30	–	–	–	–
AMU-245	1/20	1550	245	225	210	190	162	–	–	–
AMU-400	1/12	1550	400	380	365	340	315	200	–	–
AMU-525	1/4	1725	525	500	480	460	420	240	120	–
AMU-625	1/4	1725	625	600	560	540	500	420	280	100
AMU-845	1/2	1725	845	825	790	760	730	650	570	425
AMU-1100	1/3	1140	1100	1050	1000	950	860	700	–	–
Tested by The Nozzle Chamber Method as directed in A.M.C.A. Bulletin #210 Figure #4										

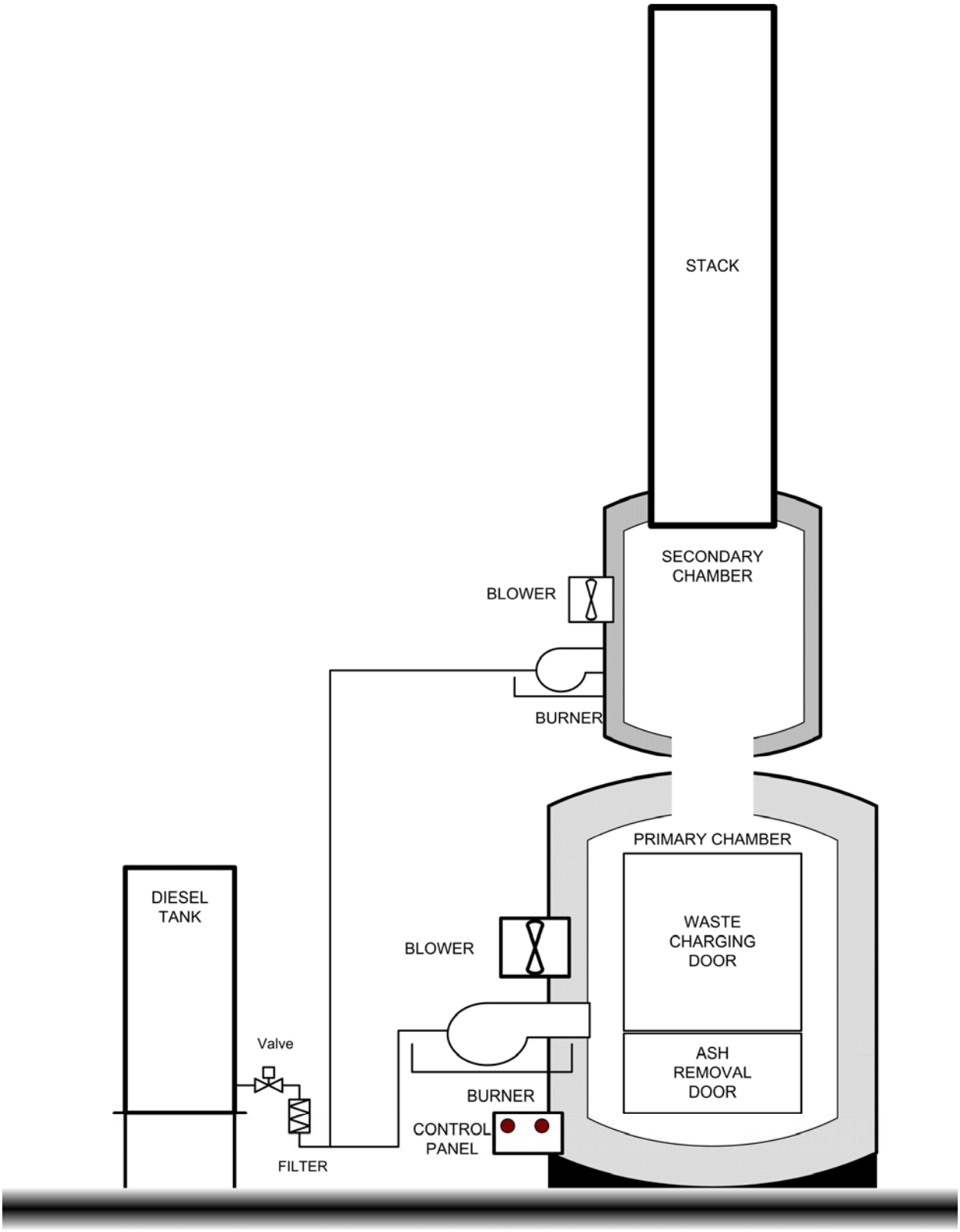


Figure 4 Schematic Diagram of Forced Air Dual-Chamber Design

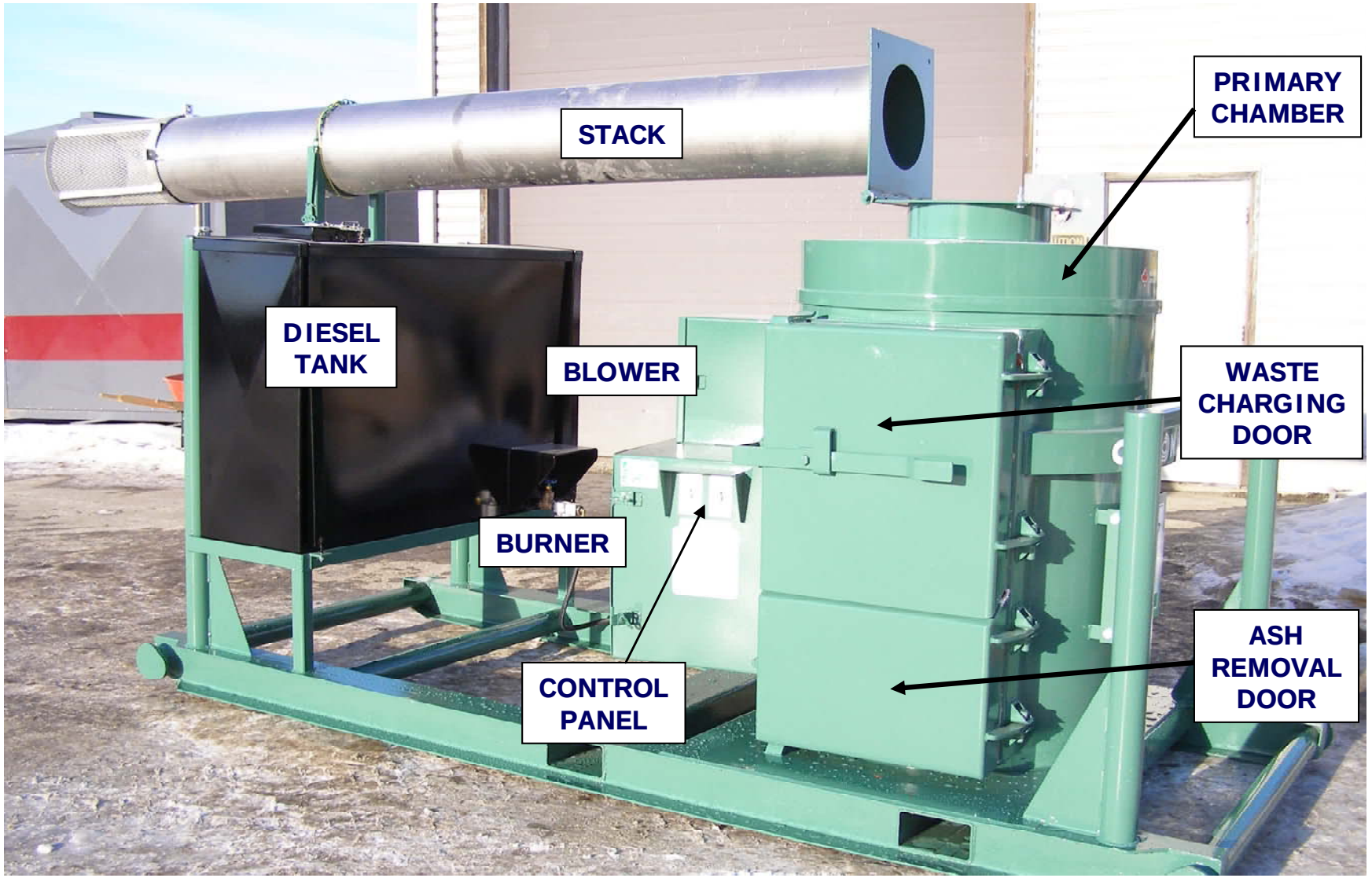


Figure 5 Photograph of the Single-Chamber Design

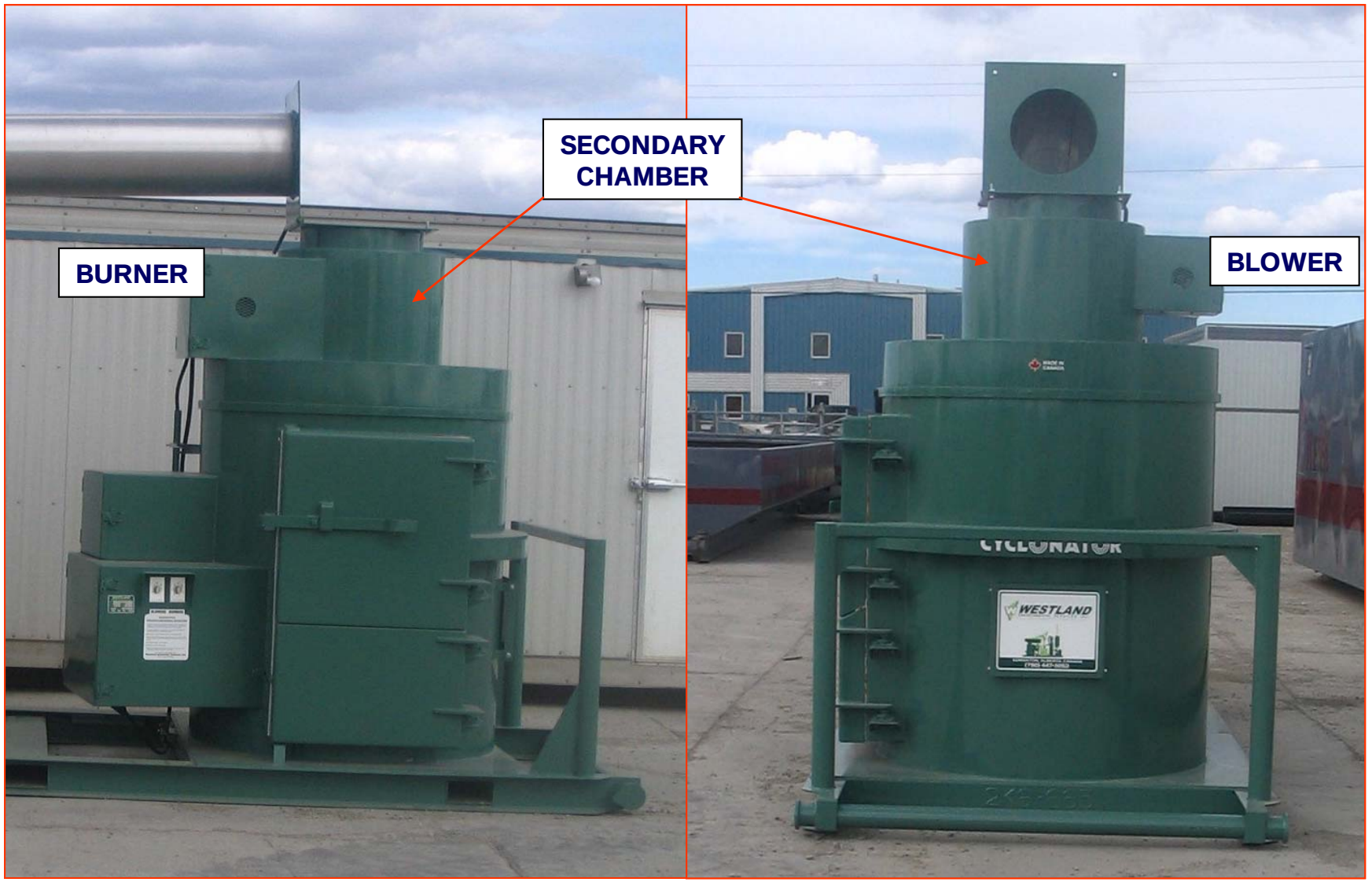


Figure 6 Photographs of the Dual-Chamber Design

Table 7 Components and Their Functions

COMPONENT	FUNCTION	DESCRIPTION
Primary Chamber	Waste combustion	WES *. Refractory lined (3 "), insulated (1")
▪ Burner	Supply heat to ignite and sustain combustion	Becket SF or Midco Incinomite
▪ Blower	Supply air (oxygen) for combustion	AMU series
Secondary Chamber	Complete combustion	WES *. Refractory lined (3"), insulated (1")
▪ Burner	Supply heat to ignite and sustain combustion	Becket SF or Midco Incinomite
▪ Blower	Supply air (oxygen) for combustion	AMU Series
Control Panel	Timers for burner and blower operations	Intermatic
Diesel Tank	Supply of auxiliary fuel	WES *
Valve	Cut off fuel to burner(s)	(General)
Filter	Prevent clogging of burner nozzle	LES 22
Stack	Disperse hot flue gas	WES *. SS Stack
Electrical System	Burner and blower operations	WES *. 115 V, 60 Hz, Single Phase

Note: WES * : Manufactured in-house. Manuals for blowers and burners are in Appendix A: Information sheets and Manuals for Burners and Blowers

4 OPERATION AND MAINTENANCE

4.1 Safety equipment

The following personal protective equipment should be used while operating the incinerator system:

- Long sleeved shirt and long pants;
- Long cuffed, puncture resistant gloves;
- CSA approved, Grade 1 safety footwear;
- CSA/ANSI approved safety glasses.

The personal protective equipment related to specific tasks are listed below:

- Ash removal and handling: NIOSH N85 respirator
- Waste charging: (i) heat protective clothing and gloves, and (2) CSA/ANSI approved full face shield.

4.2 Routine inspection and maintenance

- Check fuel lines for leak and check connections
- Check spark arrestor to ensure no plugging
- During ash removal (see next section):
  - Inspect refractory for large cracks (not expansion cracks)

- Check combustion air hole for plugging
- Inspect door gaskets for damages

4.3 Ash removal

Typically the ash from previous operation was left to cool, and ash removal is done first prior to current operation.

- Make sure combustion chamber is sufficiently cool
- (Do NOT spray water into the combustion chamber)
- While removing ash, avoid plugging the combustion air holes and damaging the burner tip
- Use non-combustible container
- Minimize dust generation
- Light water spraying on ash in the container is OK to minimize dust generation
- Dispose of ash as specified in the guidelines or regulations

4.4 Pre-operational checks

- Install stack if necessary
- Check fuel tank to make sure enough fuel (Use 5 USG/h for single-chamber, and 7.5 USG/h for dual-chamber. Actual values depend on the size of the incinerator.)
- Open fuel valve
- Re-check that combustion chamber is empty and combustion air hoes are clear
- Connect electrical plug
- Prime pump if necessary

4.5 Waste batch preparation

As previously mentioned incinerator capacity in kg/h is dependent on the heating value of the waste, which is normally not known. The nominal capacity of your incinerator is as shown in Table 5 for Type 1 to Type 3 waste, and somewhat less for Type 0.

The following cautionary notes should be followed:

- NO explosives, aerosol cans or containers containing combustible liquids
- Make sure that every batch can go through the waste charging door easily, regardless of its weight. If others prepare the batches, the operator should tell them about the maximum batch size.
- Do not open batches and "rearrange" the contents for health reasons.

4.6 Incineration

1. Re-check the burner and blower operations
2. Pre-heat the combustion chambers for 10 minutes: close doors and set the burner timer for 10 minutes
3. Load waste to Primary Chamber up to 60% of its volume
4. Start incineration: close waste charging door, set blower timer for 120 minutes and burner timer for 30 – 60 minutes depending on the amount waste loaded.
5. Check status: set timers off, open waste charging door, inspect and rake if necessary

6. If combustion is not complete, repeat Steps 4 and 5 until it is.
7. If there is more waste to be burnt, repeat Steps 3 to 6. Otherwise, go to shut-down protocol.

4.7 Shut-down

- Make sure all timers are off
- Unplug electrical connection
- Turn off fuel valve
- Un-install stack if incinerator is to be moved elsewhere.

4.8 Maintenance

In addition to the routine inspection and maintenance previously mentioned, only the burner(s) and the blower(s) require maintenance, which is quite minimum; see manuals in Appendix A: Information sheets and Manuals for Burners and Blowers. The fuel filter should be replaced every three months.

4.9 Auxiliary Fuel Consumption Rate

Figure 7 shows the volumetric flow rates of propane and diesel as a function of burner rating.

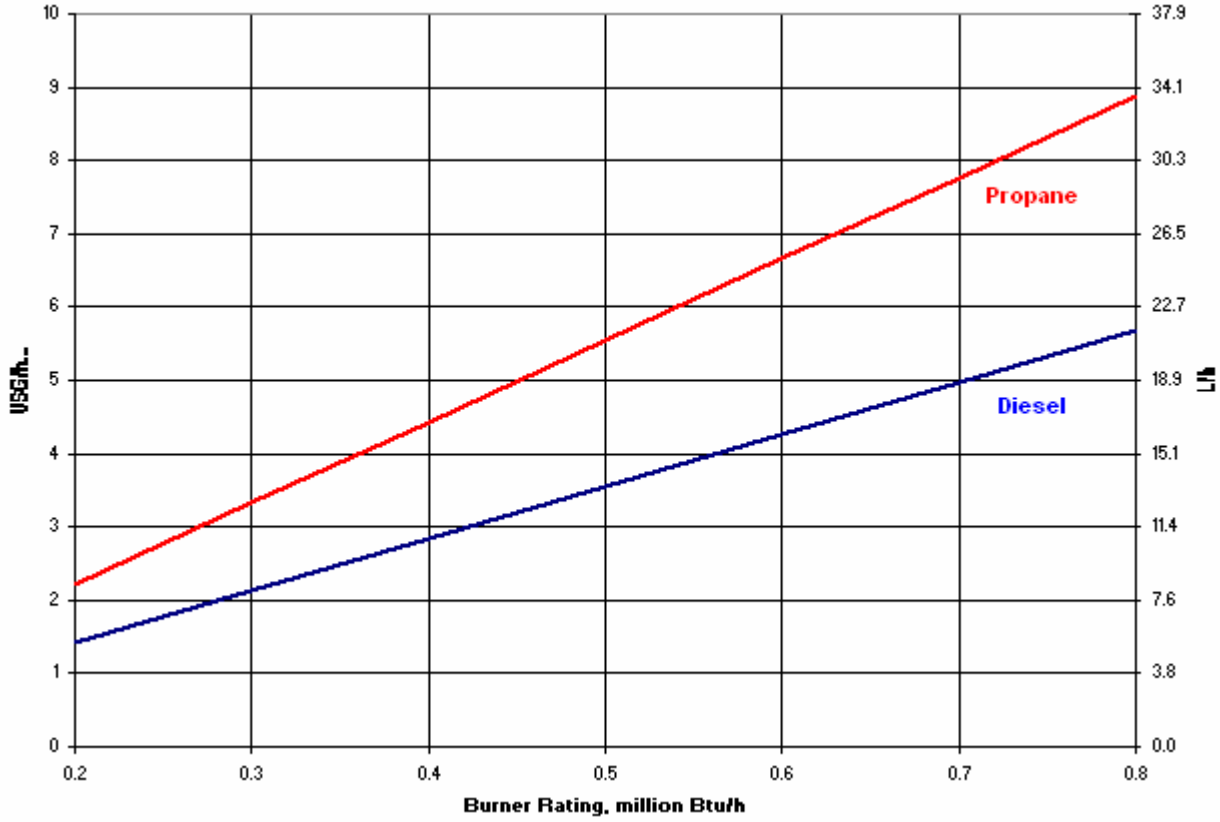


Figure 7 Consumption Rates of Propane and Diesel

5 WARRANTY

1. Westland Environmental Services Inc.. hereby warrants to the Purchaser, for a one (1) year period of time from the date of acceptance and upon the conditions hereinafter set forth, each new product sold by it, to be free from defects in material and workmanship (specifically excluding therefrom component parts and accessories manufactured, furnished, and supplied by others) under normal use, maintenance and service. Except for the above Warranty, it is agreed and understood that no other WARRANTY or CONDITION whether express, implied, or statutory is made by Westland.
2. The obligation of Westland Environmental Services Inc.. under this Warranty shall be limited to the repair or replacement (**not in excess of its factory labour rate**) of its units; which, upon examination by Westland Environmental Services Inc.., shall disclose to their satisfaction to have been defective in material and/or workmanship under normal use, maintenance, and service.
3. The foregoing shall be the Purchaser's sole and exclusive remedy whether in contract, tort, or otherwise; and Westland Environmental Services Inc.. shall not be liable for injuries to persons, for damage to property or for loss of any kind which results (whether directly or indirectly) from such defects in material or workmanship, or for any other reason; and, it is agreed and understood that the Purchaser shall keep Westland Environmental Services Inc.. indemnified against any such claim. In no event shall Westland Environmental Services Inc.. be liable for incidental or consequential damages, or commercial losses, or for any loss or damage except as set forth in paragraph 2 herein.
4. This Warranty does not apply to, and no warranty or condition is made by Westland Environmental Services Inc.. regarding any purchased components, parts, and accessories; manufactured, supplied and/or furnished by others, or any non-standard features or items specified by the Purchaser; nor does this Warranty expand, enlarge upon, or alter in any way, the warranties provided by the makers and suppliers of such component parts and accessories.
5. The liability of Westland Incinerator Co Ltd. under this Warranty shall cease and determine if:
   (a) The Purchaser shall not have paid in full all invoices as submitted by Westland Incinerator Co Ltd., or affiliated companies on or before their due dates:
   (b) Representatives of Westland Incinerator Co Ltd., are denied full and free right of access to the units:
   (c) The Purchaser permits persons other than the agents of Westland Incinerator Co Ltd. or those approved or authorized by Westland Incinerator Co Ltd. to effect any replacement of parts, maintenance, adjustments, or repairs to the units:
   (d) The Purchaser has not properly operated and maintained the units in accordance with instructions, pamphlets or directions given or issued by Westland Incinerator Co Ltd. at the time of the sale and/or from time to time thereafter:
   (e) The Purchaser uses any spare parts or replacements not manufactured by or on behalf of Westland Incinerator Co Ltd. and supplied by it, or by someone authorized by it, or fails to follow the instructions for the use of the same:
   (f) The Purchaser misuses, or uses this unit for any purpose other than that for which it was intended or manufactured:
   (g) The defective parts are not returned to Westland Incinerator Co Ltd. within 15 days of repair.
6. No condition is made or is to be implied, nor is any Warranty given or to be implied as to the life or wear of the units supplied; or that they will be suitable for use under any specific conditions; notwithstanding that such conditions may be known or made known to the seller.
7. Defects in material and/or workmanship must be brought to the attention of Westland Incinerator Co Ltd. by written notification within ten (10) days of discovery, and repairs must be commenced within forty-five (45) days thereafter.
8. It is agreed and understood that the Purchaser is responsible for and must pay for the transporting of the defective goods or of the replacement parts to the place of repair. Premium freight charges (such as air express or air fare charges for transportation of personnel, tools and for replacement parts) and other expenses, apart from servicemen's regular straight time travel, mileage, and regular straight time labour required to repair or replace defective parts and the cost of the parts, will be paid for by the customer at Westland Incinerator Co Ltd. regular billing rates on usual credit terms.
9. The liability of Westland Incinerator Co Ltd. under this Warranty is limited to the purchase price of the unit and in no case shall a claim be advanced for more than such amount.

10. All repairs and replacements are made and furnished subject to the same terms, conditions, warranties, disclaimer or warranty and limitations of liability and remedy as applied to each new unit sold.
11. This warranty and the Purchaser's rights under it, is not transferable, or is it assignable.

DATE IN SERVICE: _____

MODEL NUMBER: _____

SERIAL NUMBER: _____

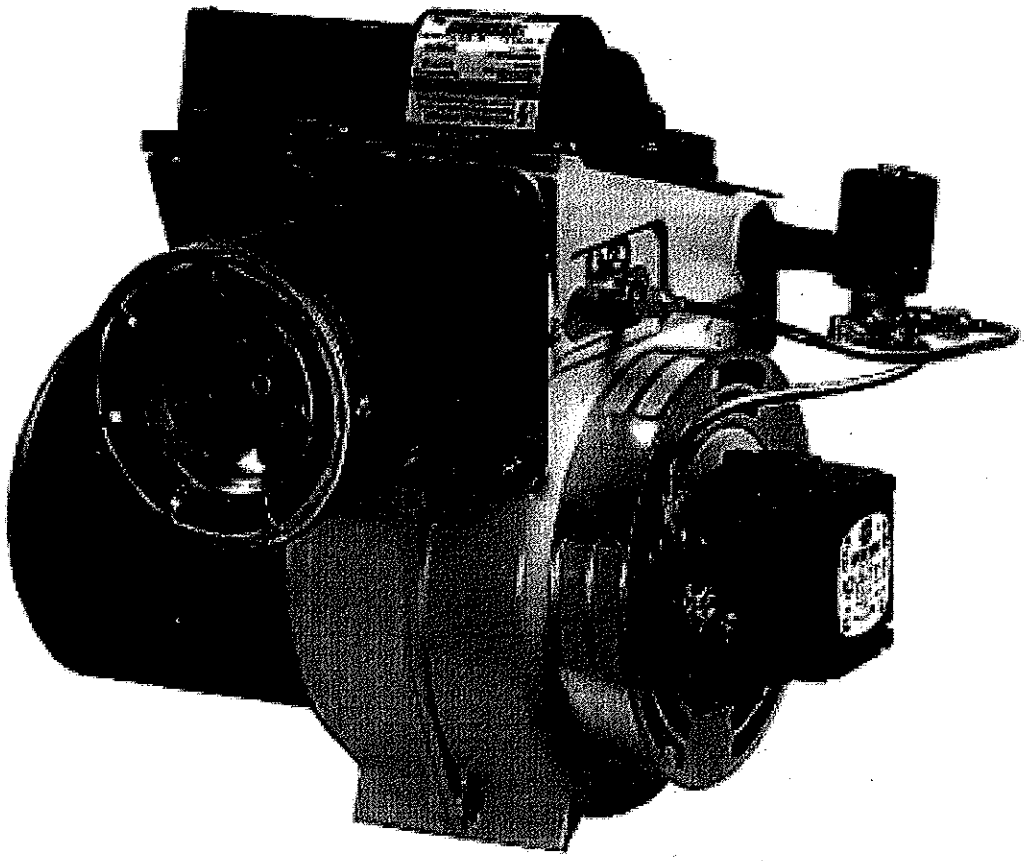
6 APPENDIX A: INFORMATION SHEETS AND MANUALS FOR BURNERS AND BLOWERS

WESTLAND
ENVIRONMENTAL SERVICES INC.
www.westlandenvironmental.com

CY 2050 FA "D" PARTS LIST

Description	Part #
Gun Burner Beckett, WIC 201 x 6"	7007006
Air Tube Combination for WIC 201	7900188
Coupling, Flex for WIC 201	7009183
Fuel Pump A2YA7916 Suntec	7009182
Blower Wheel for WIC 201	7009184
Transformer, Ignition "S" for WIC 201	7009187
Stainless Steel Stack, 15" dia x 10'	7030101
Spark Arrester, Stainless Steel 15"	7030107
Nozzle (specify GPH, angle, pattern)	7006122
Gasket, Ceramic Fibre 1/4" x 2" (price per foot)	7000062
Gasket Cement, HT Silicone Tube	7000064
Refractory Cement Bag	7000120
Timer, 60 min Spring Wound	7000145
Timer, Blower 120m Spring Wound	7000146
Filter Adaptor	7001116
Filter, Fuel LFF22	7001117
Fuel Tank, 250 gal. Double Wall Enviro	7041112
AMU625 Blower	7000058
Delhi Blower D530	7000054
AMU 245 Blower (replaces the Delhi Blower D530 on 2007 and newer models)	7000075

Models SF & SM Oil Burners



WARNING **Potential for Fire, Smoke and Asphyxiation Hazards**

Incorrect installation, adjustment, or misuse of this burner could result in death, severe personal injury, or substantial property damage.

To the Homeowner or Equipment Owner:

- Please read and carefully follow all instructions provided in this manual regarding your responsibilities in caring for your heating equipment.
- Contact a professional, qualified service agency for installation, start-up or service work.
- Save this manual for future reference.

To the Professional, Qualified Installer or Service Agency:

- Please read and carefully follow all instructions provided in this manual before installing, starting, or servicing this burner or heating system.
- The Installation must be made in accordance with all state and local codes having jurisdiction.

Table of Contents

Information To Be Used Only By Qualified Service Technicians

Owner's Information

To the Owner:

Thank you for purchasing a Beckett burner for use with your heating appliance. Please pay attention to the Safety Warnings contained within this instruction manual. Keep this manual for your records and provide it to your qualified service agency for use in professionally setting up and maintaining your oil burner.

Your Beckett burner will provide years of efficient operation if it is professionally installed and maintained by a qualified service technician. If at any time the burner does not appear to be operating properly, **immediately contact your qualified service agency** for consultation.

We recommend annual inspection/service of your oil heating system by a qualified service agency.

Daily – Check the room in which your burner/appliance is installed. Make sure:

- Air ventilation openings are clean and unobstructed
- Nothing is blocking burner inlet air openings
- No combustible materials are stored near the heating appliance
- There are no signs of oil or water leaking around the burner or appliance

Weekly

- Check your oil tank level. Always keep your oil tank full, especially during the summer, in order to prevent condensation of moisture on the inside surface of the tank.

WARNING Owner's Responsibility

Incorrect installation, adjustment, and use of this burner could result in severe personal injury, death, or substantial property damage from fire, carbon monoxide poisoning, soot or explosion.

Contact a professional, qualified service agency for the installation, adjustment and service of your oil heating system. This work requires technical training, trade experience, licensing or certification in some states and the proper use of special combustion test instruments.

Please carefully read and comply with the following instructions:

- Never store or use gasoline or other flammable liquids or vapors near this burner or appliance.
- Never attempt to burn garbage or refuse in this appliance.
- Never attempt to light the burner/appliance by throwing burning material into the appliance.
- Never attempt to burn any fuel not specified and approved for use in this burner.
- Never restrict the air inlet openings to the burner or the combustion air ventilation openings in the room.

NOTICE

This manual contains information that applies to both SM and SF burners. These burners may appear to be basically identical, but there are differences in design and performance. Please review the comparison chart below:

Feature	SM	SF
Firing Rate Range	1.25 to 3.00 gph	1.25 to 5.50 gph
Motor	1/5 HP	1/4 HP
Fuel pump capacity	3 gph (standard)	7 gph (standard)
UL Air Tube Combinations	See Table 2	See Table 2
Blocking oil solenoid valve	Optional	Required above 3 gph
Primary control lockout timing	15 to 45 seconds (optional)	15 seconds maximum

Hazard Definitions

DANGER **Indicates an imminently hazardous situation, which, if not avoided, will result in death, serious injury, or property damage.**

WARNING **Indicates a potentially hazardous situation, which, if not avoided, could result in death, severe personal injury, and/or substantial property damage.**

CAUTION **Indicates a potentially hazardous situation, which, if not avoided, may result in personal injury or property damage.**

Within the boundaries of the hazard warning, there will be information presented describing consequences if the warning is not heeded and instructions on how to avoid the hazard.

NOTICE

Intended to bring special attention to information, but not related to personal injury or property damage.

General Information

Table 1 – Burner Specifications

Model SM Capacity (Note1)	Firing rate range: .....01.25 – 3.00 GPH Input: ..... 175,000 – 420,000 Btu/hr
Model SF Capacity (Note1)	Firing rate range:.....1.25 - 5.50 GPH Input: .....175,000 – 770,000 Btu/hr
Certifications/ Approvals	Model SM - UL listed to comply with ANSI/ UL296 & certified to CSA B140.0. Model SF - UL listed to comply with ANSI/UL 296 & certified to CSA B140.0.
Fuels	U. S: No.1 or No.2 heating oil only (ASTM D396) Canada: No. 1 stove oil or No. 2 furnace oil only
Electrical	Power supply: ..... 120 volts AC, 60 Hz, single phase Operating load (SM): .....5.8 Amps max Operating load (SF): .....7.1 Amps max Motor (SM): ..... 1/5 hp, 3450 rpm, NEMA 'N' flange, manual reset over load protection Motor (SF): ..... 1/4 hp, 3450 rpm, NEMA 'N' flange, manual reset over load protection Ignition: ... Continuous duty solid-state igniter
Fuel pump	Outlet pressure: .....Note 2
Air tube	ATC code: .....See Table 2
Dimensions (Standard)	Height .....12.5 inches Width .....15 inches Depth ..... 8.50 inches Air tube diameter ..... 4.00 inches
Air tube	ATC code: .....See Table 2

Note 1: *Approval agency listed rating for Model SM is 1.25 to 3.00 gph and Model SF is 1.25 to 5.50 gph. However, the firing rate range is limited by the specific air tube combination being used. Refer to Table 2.*

Note 2. *UL Recognized to 4.0 GPH with a CleanCut pump for use in pressure washers.*

Note 3. *See appliance manufacturer's burner specifications for recommended pump discharge pressure.*

• Notice Special Requirements

- For recommended installation practice in Canada, refer to the latest version of CSA Standard B139 & B140.
- Concealed damage — If you discover damage to the burner or controls during unpacking, notify the carrier at once and file the appropriate claim.
- When contacting Beckett for service information — Please record the burner serial number (and have available when calling or writing). You will find the serial number on the silver label located on the left rear of the burner. Refer to Figure 1.

WARNING **Professional Service Required**

Incorrect installation, adjustment, and use of this burner could result in severe personal injury, death, or substantial property damage from fire, carbon monoxide poisoning, soot or explosion.

Please read and understand the manual supplied with this equipment. This equipment must be installed, adjusted and put into operation only by a qualified individual or service agency that is:

- Licensed or certified to install and provide technical service to oil heating systems.
- Experienced with all applicable codes, standards and ordinances.
- Responsible for the correct installation and commission of this equipment.
- Skilled in the adjustment of oil burners using combustion test instruments.

The installation must strictly comply with all applicable codes, authorities having jurisdiction and the latest revision of the National Fire Protection Association Standard for the installation of Oil-burning Equipment, NFPA 31 (or CSA B139 and B140 in Canada).

Regulation by these authorities take precedence over the general instructions provided in this installation manual.

Table 2 – Air Tube Combination (ATC) codes

Firing Rate (gph)	Head	Static plate size	ATC Codes for usable air tube lengths ('A' in inches; See Figure 3.)			
(min-max)		(inches)	6-5/8	9	13	16
For SF Burner Only						
1.25-2.25	F12	2-3/4	SF65VW	SF90VW	SF130VW	SF160VW
1.75-2.75	F22	2-3/4	SF65VP	SF90VP	SF130VP	SF160VP
1.75-3.25	F220	None	SF65FD	SF90FD	SF130FD	SF160FD
2.5-5.5	F310	None	SF65FU	SF90FU	SF130FU	SF160FU
For SM Burner Only						
1.25-2.00	F12	2-3/4	SM65VW	SM90VW	SM130VW	SM160VW
2.00-3.00	F220	None	SM65FF	SM90FF	SM130FF	SM160FF
2.00-3.00	F22	None	SM65VM	SM90VM	SM130VM	SM160VM

Inspect/Prepare Installation Site

• Chimney or vent

- Inspect the chimney or vent, making sure it is properly sized and in good condition for use.
- For those installations not requiring a chimney, such as through-the-wall vented appliances, follow the instructions given by the appliance and power venter (if used) manufacturers.

• Combustion air supply

WARNING **Adequate Combustion and Ventilation Air Supply Required**

Failure to provide adequate air supply could seriously affect the burner performance and result in damage to the equipment, asphyxiation, explosion or fire hazards.

- The burner cannot properly burn the fuel if it is not supplied with a reliable combustion air source.
- Follow the guidelines in the latest editions of the NFPA 31 and CSA-B139 regarding providing adequate air for combustion and ventilation.

See NFPA 31 Standard for complete details.

Appliance located in confined space

The confined space should have two (2) permanent openings: one near the top of the enclosure and one near the bottom of the enclosure. Each opening shall have a free area of not less than (1) one square inch per 1,000 BTU's per hour of the total input rating of all appliances within the enclosure. The openings shall have free access to the building interior, which should have adequate infiltration from the outside.

Exhaust fans and other air-using devices

Size air openings large enough to allow for all air-using devices in addition to the minimum area required for combustion air. If there is any possibility of the equipment room developing negative pressure (because of exhaust fans or clothes dryers, for example), either pipe combustion air directly to the burner or provide a sealed enclosure for the burner and supply it with its own combustion air supply.

• Clearances to burner and appliance

- Provide space around burner and appliance for easy service and maintenance.
- Check minimum clearances against those shown by the appliance manufacturer and by applicable building codes.

• Combustion chamber — Burner retrofitting

Verify that the appliance combustion chamber provides at least the minimum dimensions given in Table 3.

Table 3. Chamber Dimensions

Chamber Dimensions (inches)					
Firing Rate (GPH)	Round I.D.	Rectangular		Height	Floor to nozzle
		Width	Length		
1.25	11	10	11	12	5-6
1.50	12	11	12	13	6-7
2.00	14	12	15	13	6-7
2.50	16	13	17	14	7-8
3.00	18	14	18	15	7-8
3.50	19	15	19	15	7-8
4.00	20	16	21	16	8-9
5.00	23	18	23	18	9-10
5.50	24	19	24	19	10-11

WARNING **Protect Steel Combustion Chamber From Burnout**

Failure to comply could result in damage to the heating equipment and result in fire or asphyxiation hazards.

- When retrofitting appliances that have unlined stainless steel combustion chambers, protect the chamber by lining the inside surfaces with a ceramic fiber blanket, such as a wet-pac or other suitable refractory material.
- Some steel chambers may not require liners because the appliance was designed and tested for use with flame retention burners. Refer to the manufacturer's instructions.

Prepare the Burner

• Burner fuel unit

Verify that the burner fuel unit is compatible with the oil supply system. For more details, refer to "Connect fuel lines" later in this manual.

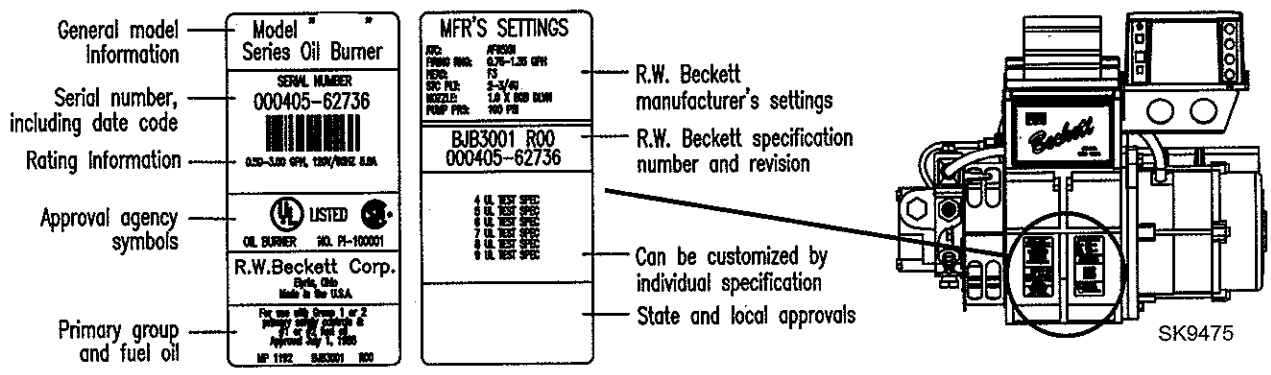
• Attach air tube (if not already installed)

If using a flange and gasket, slide them onto the air tube. Then attach the air tube to the burner chassis using the four sheet metal screws provided. Refer to Figure 3 for details.

• Install burner nozzle (if not already installed)

1. Remove the plastic plug protecting the nozzle adapter threads
2. Place a ¾" open-end wrench on the nozzle adapter. Insert the nozzle into the adapter and finger tighten. Finish tightening with a ⅝" open-end wrench. Use care to avoid bending the electrodes.

Figure 1. Burner Label Location



WARNING Correct Nozzle and Flow Rate Required

Incorrect nozzles and flow rates could result in impaired combustion, under-firing, over-firing, sooting, puff-back of hot gases, smoke and potential fire or asphyxiation hazards.

Use only nozzles having the brand, flow rate (gph), spray angle and pattern specified by the appliance manufacturer.

Follow the appliance manufacturer's specifications for the required pump outlet pressure for the nozzle, since this affects the flow rate.

- Nozzle manufacturers calibrate nozzle flow rates at 100 psig.
- When pump pressures are higher than 100 psig, the actual nozzle flow rate will be greater than the gph stamped on the nozzle body. (Example: A 1.00 gph nozzle at 140 psig = 1.18 gph)

Securely tighten the nozzle (torque to 90 inch pounds). For typical nozzle flow rates at various pressures refer to Table 5.

Table 5. Nozzle Flow Rate by Size

Nozzle flow rate U. S. gallons per hour of No. 2 fuel oil when pump pressure (psig) is:					
Nozzle size (rated at 100 psig)	**125 psi**	**140 psi**	**150 psi**	**175 psi**	**200 psi**
1.25	1.39	1.48	1.53	1.65	1.77
1.35	1.51	1.60	1.65	1.79	1.91
1.50	1.68	1.77	1.84	1.98	2.12
1.65	1.84	1.95	2.02	2.18	2.33
1.75	1.96	2.07	2.14	2.32	2.48
2.00	2.24	2.37	2.45	2.65	2.83
2.25	2.52	2.66	2.76	2.98	3.18
2.50	2.80	2.96	3.06	3.31	3.54
2.75	3.07	3.25	3.37	3.64	3.90
3.00	3.35	3.55	3.67	3.97	4.24
3.25	3.63	3.85	3.98	4.30	4.60
3.50	3.91	4.14	4.29	4.63	4.95
3.75	4.19	4.44	4.59	4.96	5.30
4.00	4.47	4.73	4.90	5.29	-
4.50	5.04	5.32	5.51	-	-
5.00	5.59	-	-	-	-
5.50	-	-	-	-	-

Table 6. Nozzle Spray Angles

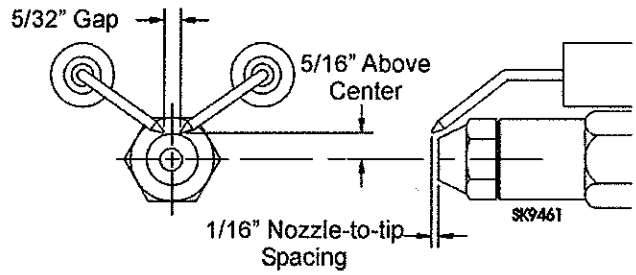
Recommended nozzle spray angles	
"F" head	70°, 80° or 90° nozzle

Note: Always follow the appliance manufacturer's nozzle specification, when available.

3. If the nozzle is already installed, remove the nozzle line assembly to verify that the nozzle size and spray pattern are correct for the application (per appliance manufacturer's information). Verify that the electrode tip settings comply with Figure 2.
4. If the nozzle is not installed, obtain a nozzle having the capacity and spray angle specified in the appliance manufacturer's information. For conversions or upgrades, when information is not available for the application:
   - Refer to Table 6 to select the mid-range nozzle spray angle for the head type being used.
   - Fire the burner and make sure the combustion is acceptable and the flame is not impinging on chamber surfaces.
   - If a shorter flame is needed, select a wider spray angle. If a longer flame is needed, select a narrower spray angle.
   - Either hollow or solid spray patterns may be used. If combustion results are not satisfactory with the selected spray pattern, try the other pattern.

• Check/adjust electrodes

Figure 2. – Electrode Tip Adjustment



Check the electrode tip settings. Adjust if necessary to comply with the dimensions shown in Figure 2. To adjust, loosen the electrode clamp screw and slide/rotate electrodes as necessary. Securely tighten the clamp screw when finished.

• Servicing nozzle line assembly

1. Turn off power to burner before proceeding.
2. Disconnect oil connector tube from nozzle line.
3. Loosen the two screws securing igniter retaining clips and rotate both clips to release igniter baseplate. Then tilt igniter back on its hinge.
4. Remove splined nut.
5. "F" head air tube. - Remove nozzle line assembly from burner, being careful not to damage the electrodes or insulators while handling. To ease removal of long assemblies (over 9 inches), rotate assembly 180° from installed position after pulling partially out of tube.
6. To replace the nozzle assembly, reverse the above steps.

Mount Burner on Appliance

WARNING **Do Not use Adjustable Mounting Flange on Mobile Units**

The shock and vibration could cause loss of burner alignment and insertion problems resulting in flame impingement, heavy smoke, fire and equipment damage.

- Only use specified factory-welded flange and air tube combinations.

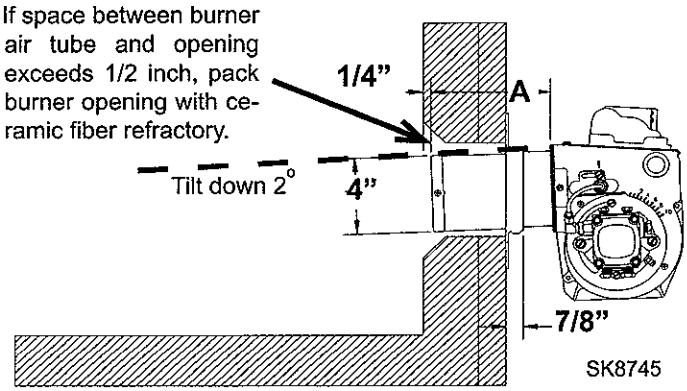
• Mounting options

Bolt the burner to the appliance using the factory-mounted flange or an adjustable flange.

• Mounting dimensions

1. When using the Beckett universal adjustable flange, mount the air tube at a 2° downward pitch unless otherwise specified by the appliance manufacturer.
2. Verify that the air tube installed on the burner provides the correct insertion depth. See Figure 3.
3. The end of the air tube should normally be ¼" back from the inside wall of the combustion chamber. Never allow the leading edge of the head assembly to extend into the chamber, unless otherwise specified by the heating appliance manufacturer. Carefully measure the insertion depth when using an adjustable flange. Verify the insertion depth when using a welded flange.

Figure 3. – Mounting Burner in Appliance



• Connect fuel lines

Carefully follow the fuel unit manufacturer's literature and the latest edition of NFPA 31 for oil supply system specifications.

WARNING **Do Not Install By-pass Plug with 1-Pipe System**

Failure to comply could cause immediate pump seal failure, pressurized oil leakage and the potential for a fire and injury hazard.

- The burner is shipped without the by-pass plug installed. **EXCEPTION**: Unless specified by the equipment manufacturer and noted on the label at top of pump cover.
- Install the by-pass plug in two-pipe oil supply systems ONLY.

CAUTION **Oil Supply Pressure Control Required**

Damage to the filter or pump seals could cause oil leakage and a fire hazard.

- The oil supply inlet pressure to the burner ***cannot exceed 3 psig***.
- Insure that a pressure limiting device is installed in accordance with the latest edition of NFPA 31.
- Do not install valves in the return line. (NFPA 31, Chapter 8)
- **Gravity Feed Systems:** Always install an anti-siphon valve in the oil supply line or a solenoid valve (RWB Part # 2182602U or 2233U) in the pump/nozzle discharge tubing to provide backup oil flow cut-off protection.

Fuel supply level with or above burner –
The burner may be equipped with a single-stage fuel unit for these installations. Connect the fuel supply to the burner with a single supply line if you want a one-pipe system (making sure the bypass plug is NOT installed in the fuel unit.) Manual bleeding of the fuel unit is required on initial start-up. If connecting a two-pipe fuel supply, install the fuel unit bypass plug.

Fuel supply below the level of the burner –
When the fuel supply is more than eight feet below the level of the burner, a two-pipe fuel supply system is required. Depending on the fuel line diameter and horizontal and vertical length, the installation may also require a two-stage pump. Consult the fuel unit manufacturer's literature for lift and vacuum capability.

Check/Adjust 'Z' Dimension for 'F' Heads

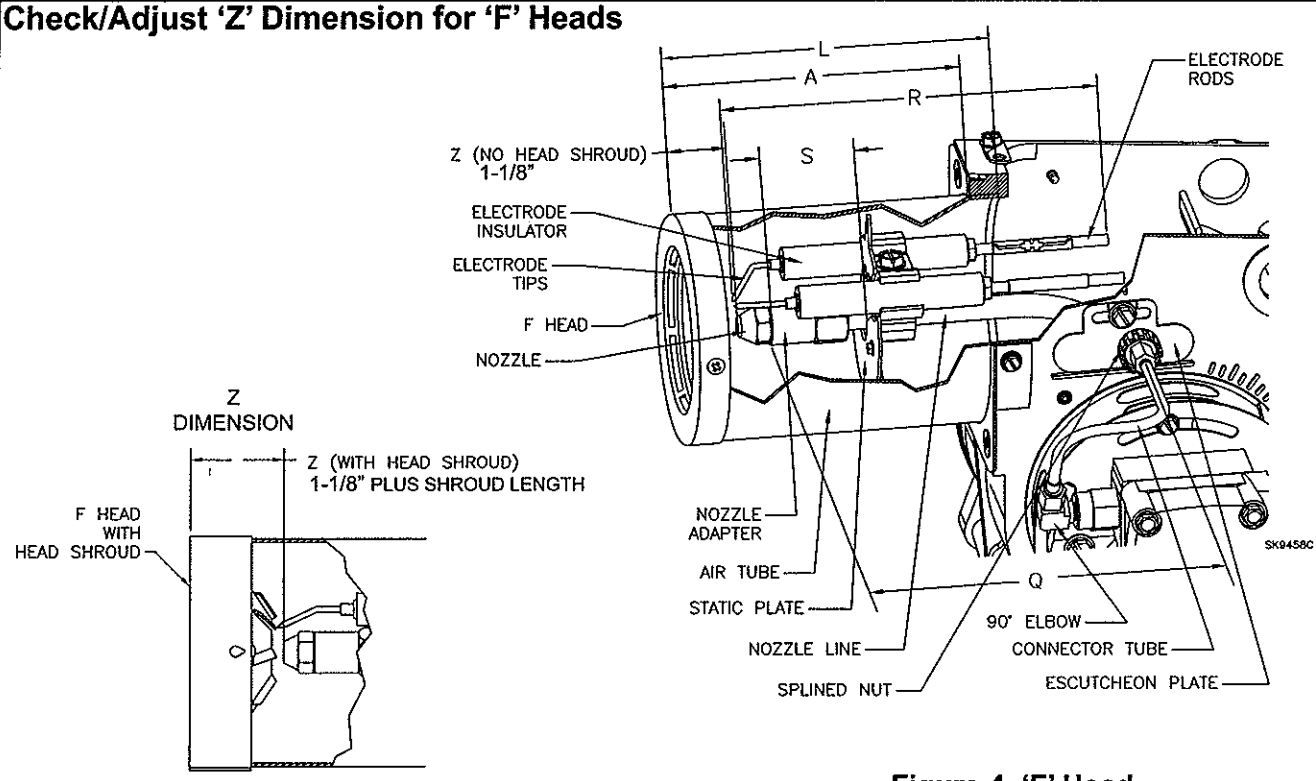


Figure 4. 'F' Head

• Check/Adjust 'Z' Dimension - 'F' heads

WARNING **Adjust the 'Z' dimension to the required specification.**

Incorrect Adjustments could cause combustion problems, carbon deposition from flame impingement, heavy smoke generation and fire hazard.

- Make all adjustments exactly as outlined in the following information.

1. The important 'Z' dimension is the distance from the face of the nozzle to the flat face of the head (or heat shield, if applicable). This distance for F heads is 1-⅛" (1-⅜" if the air tube has a heat shield). The "Z" dimension is factory set for burners shipped with the air tube installed. Even if factory set, verify that the "Z" dimension has not been changed.
2. Use the following procedure to adjust the "Z" dimension, if it is not correct:
   - Turn off power to the burner.
   - Disconnect the oil connector tube from the nozzle line
   - See above figure. Loosen the splined nut from the nozzle line. Loosen the hex head screw securing the escutcheon plate to the burner housing.
   - Place the end of a ruler at the face of the nozzle and, using a straight edge across the head, measure the distance to the face of the head. A Beckett T501 or T650 gauge may also be used.
   - Slide the nozzle line forward or back until the Z dimension for F heads is 1-⅛" (1-1/8" plus shroud length, if using a straight edge).
   - Tighten the hex head screw to secure the escutcheon plate to the burner chassis. Then tighten the splined nut and attach the oil connector tube.
3. Recheck the "Z" dimension periodically when servicing to ensure the escutcheon plate has not been moved. You will need to reset the "Z" dimension if you replace the air tube or nozzle line assembly. The Beckett Z gauge (part number Z-2000) is available to permit checking the F head "Z" dimension without removing the burner from the appliance.

• Burner Dimensions - Models SM & SF

Dimension (inches)	F Head
A = Usable air length (inches)	(Measure accurately)
L (Total tube length)	A+1/2
R (electrode length), ± 1/4	A+2-1/4
S (adapter to static plate), ± 1/16	(Note 1)
Q (nozzle line length),	A+ 15/16
Z (F head w/o head shroud) (F head-with head shroud)	1-1/8 1-1/8 + shroud length. (Note 2)

Note 1: 1-3/8 for dimension A less than 4"; 1-5/8 for dimension A from 4" through 4-1/2 ", 2-13/32 for dimension A greater than 4-1/2".
Note 2: When using a straight edge.

Fuel line installation –

CAUTION Do Not Use Teflon Tape

Damage to the pump could cause impaired burner operation, oil leakage and appliance soot-up.

- Never use Teflon tape on fuel oil fittings.
- Tape fragments can lodge in fuel line components and fuel unit, damaging the equipment and preventing proper operation.
- Use of Teflon tape will void the Suntec warranty.
- Use oil-resistant pipe sealant compounds.

Continuous lengths of heavy wall copper tubing are recommended. **Always use flare fittings. Never use compression fittings.**

- Always install fittings in accessible locations. Proper routing of fuel lines is required to prevent air cavitation and vibration.

Fuel line valve and filter –

- Install two high quality fusible-handle design shutoff valves in accessible locations on the oil supply line to comply with the NFPA 31 Standard and authorities having jurisdiction. Locate one close to the tank and the other close to the burner, upstream of the filter.
- Install a generous capacity filter inside the building between the fuel tank shutoff valve and the burner, locating both the filter and the valve close to the burner for ease of servicing. Filter should be rated for 50 microns or less.

Wire Burner

WARNING Electrical Shock Hazard

Electrical shock can cause severe personal injury or death.

- Disconnect electrical power before installing or servicing the burner.
- Provide ground wiring to the burner, metal control enclosures and accessories. (This may also be required to aid proper control system operation.)
- Perform all wiring in compliance with the National Electrical Code ANSI/NFPA 70 (Canada CSA C22.1)

• Burner packaged with appliance

Refer to appliance manufacturer's wiring diagram for electrical connections.

• Burner installed at jobsite

Refer to Figure 5, for typical burner wiring, showing cad cell primary controls. Burner wiring may vary, depending on primary control actually used.

The R7184 primary control with valve-on delay (prepurge) and burner motor-off delay (postpurge), requires a constant 120 volts AC power source supplied to the BLACK wire on the control. The RED wire goes to the appliance limit circuit. Please note that other control manufacturers may use different wire colors for power and limit connections.

Start Up Burner/Set Combustion

WARNING Explosion and Fire Hazard

Failure to follow these instructions could lead to equipment malfunction and result in heavy smoke emission, soot-up, hot gas puff-back, fire and asphyxiation hazards.

- Do not attempt to start the burner when excess oil has accumulated in the appliance, the appliance is full of vapor, or when the combustion chamber is very hot.
- Do not attempt to re-establish flame with the burner running if the flame becomes extinguished during start-up, venting, or adjustment.
- **Vapor-Filled Appliance:** Allow the unit to cool off and all vapors to dissipate before attempting another start.
- **Oil-Flooded Appliance:** Shut off the electrical power and the oil supply to the burner and then clear all accumulated oil before continuing.
- If the condition still appears unsafe, contact the Fire Department. Carefully follow their directions.
- Keep a fire extinguisher nearby and ready for use.

1. Open the shutoff valves in the oil supply line to the burner.
2. If the air control is not preset, close air band and partially open air shutter. This is an initial air setting for the pump bleeding procedure only. Additional adjustments must be made with instruments to prevent smoke and carbon monoxide generation.
3. Set the thermostat substantially above room temperature.

Typical Burner Wiring & Burner Sequence of Operation for R7184 Control.

Refer to the appliance manufacturer's wiring diagram for actual specifications.

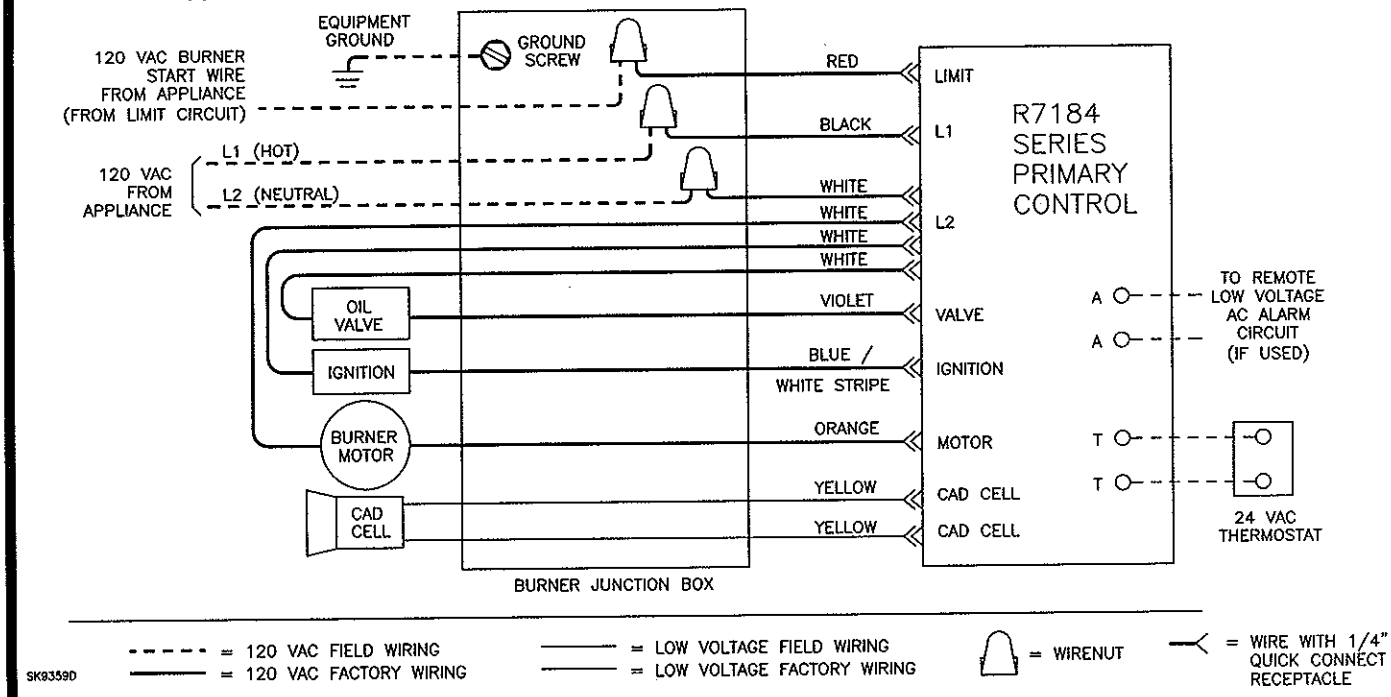
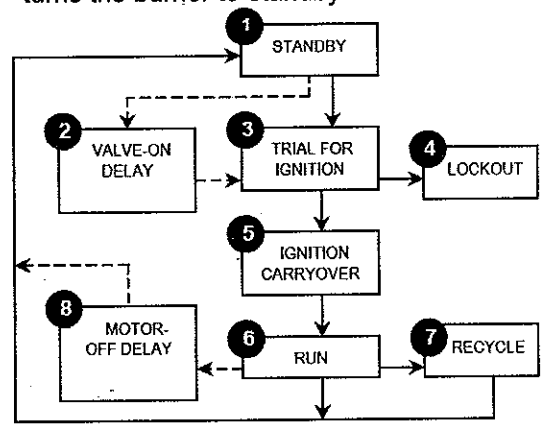


Figure 5. – Typical Burner Wiring

1. **STANDBY.** The burner is idle, waiting for a call for heat. When a call for heat is initiated, there is a 3-10 second delay while the control performs a safe start check.
2. **VALVE-ON DELAY.** The ignition and motor are turned on for a 15 second valve-on delay.
3. **TRIAL FOR IGNITION (TFI).** The fuel valve is opened. A flame should be established within the 15 second lockout time.
4. **LOCKOUT.** If flame is not sensed by the end of the TFI, the control shuts down on safety lockout and must be manually reset. If the control locks out three times in a row, the control enters restricted lockout.
5. **IGNITION CARRYOVER.** Once flame is established, the ignition remains on for 10 seconds to ensure flame stability before turning off. If the control is wired for intermittent duty ignition, the ignition unit stays on the entire time the motor is running.
6. **RUN.** The burner runs until the call for heat is satified. The burner is then sent to burner motor off delay, if applicable, or it is shut down and sent to standby.
7. **RECYCLE.** If the flame is lost while the burner is firing, the control shuts down the burner, enters a 60 second recycle delay, and then repeats the above ignition sequence. If flame is lost three times in a row, the control locks out to prevent cycling with repetitious flame loss due to poor combustion.
8. **BURNER MOTOR-OFF DELAY.** The fuel valve is closed and the burner motor is kept on for the selected motor-off delay time before the control returns the burner to standby.



Control System Features

Feature	Interrupted ignition	Limited reset, Limited recycle	Diagnostic LED, cad cell indicator	Valve-on delay	Burner motor off delay	Alarm Contacts
R7184A	YES	YES	YES	—	—	—
R7184B	YES	YES	YES	YES	—	—
R7184P	YES	YES	YES	YES	YES	Optional

4. Close the line voltage switch to start the burner. If the burner does not start immediately you may have to reset the safety switch of the burner primary control.
5. Bleed air from fuel unit as soon as burner motor starts rotating.
   - To bleed the fuel unit, attach a clear plastic hose over the vent fitting. Loosen the fitting and catch the oil in an empty container. Tighten the fitting when all air has been purged from the oil supply system.
   - If the burner locks out on safety during bleeding, reset the safety switch and complete the bleeding procedure. Note — Electronic safety switches can be reset immediately; others may require a three- to five-minute wait.
   - If burner stops after flame is established, additional bleeding is probably required. Repeat the bleeding procedure until the pump is primed and a flame is established when the vent fitting is closed.
   - For R7184 primary controls, see Technician's Quick Reference Guide, part number 61351 for special pump priming sequence.
   - Prepare for combustion tests by drilling a ¼" sampling hole in the flue pipe between the appliance and the barometric draft regulator.
6. Initial air adjustment — Test the flue gas for smoke. Adjust the air shutter (and air band, if necessary) to obtain a clean flame. Now the additional combustion tests with instruments can be made

• Set combustion with instruments

1. Allow the burner to run for approximately 5 to 10 minutes.
2. Set the stack or over-fire draft to the level specified by the appliance manufacturer.
   - **Natural Draft Applications;** typically over-fire draft is -0.01" or -0.02" w.c.
   - **Direct Venting**; typically may not require draft adjustment.
   - **High Efficiency/Positive Pressure Appliances**; also vary from traditional appliances (see manufacturer's recommendations).
3. Follow these four steps to properly adjust the burner:
   Step 1: Adjust the air shutter/band until a trace of smoke is achieved.
   Step 2: At the trace of smoke level, measure the CO_2 (or O_2) . This is the vital reference point for further adjustments. Example: 13.5% CO_2 (2.6% O_2)
   Step 3: Increase the air to reduce the CO_2 by 1.5 to 2 percentage points. (O_2 will be increased by approximately 2.0 to 2.7 percentage points.) Example: Reduce CO_2 from 13.5% to 11.5% (2.6% to 5.3% O_2).
   Step 4: Recheck smoke level. It should be Zero.
      - This procedure provides a margin of reserve air to accommodate variable conditions.
      - If the draft level has changed, recheck the smoke and CO2 levels and readjust the burner, if necessary
4. Once combustion is set, tighten all fasteners on air band, air shutter and escutcheon plate.
5. Start and stop the burner several times to ensure satisfactory operation. Test the primary control and all other appliance safety controls to verify that they function according to the manufacturer's specifications.

Perform Regular Maintenance

WARNING **Annual Professional Service Required**

Tampering with or making incorrect adjustments could lead to equipment malfunction and result in asphyxiation, explosion or fire.

- Do not tamper with the burner or controls or make any adjustments unless you are a trained and qualified service technician.
- To ensure continued reliable operation, a qualified service technician must service this burner annually.
- More frequent service intervals may be required in dusty or adverse environments.
- Operation and adjustment of the burner requires technical training and skillful use of combustion test instruments and other test equipment.

- ❒ Replace the oil supply line filter. The line filter cartridge must be replaced to avoid contamination of the fuel unit and nozzle.
- ❒ Inspect the oil supply system. All fittings should be leak-tight. The supply lines should be free of water, sludge and other restrictions.
- ❒ Remove and clean the pump strainer if applicable.
- ❒ Replace the nozzle with the exact brand, pattern, gph flow rate and spray angle..
- ❒ Clean and inspect the electrodes for damage, replacing any that are cracked or chipped.
- ❒ Check electrode tip settings. Replace electrodes if tips are rounded.
- ❒ Inspect the igniter spring contacts.
- ❒ Clean the cad cell lens surface, if necessary.
- ❒ Inspect all gaskets. Replace any that are damaged or would fail to seal adequately.
- ❒ Inspect the combustion head and air tube. Remove any carbon or foreign matter. Replace all damaged units with exact parts.
- ❒ Clean the blower wheel, air inlet, air guide, burner housing and static plate of any lint or foreign material.
- ❒ If motor is not permanently lubricated, oil motor with a few drops of SAE 20 nondetergent oil at each oil hole. DO NOT over oil motor. Excessive oiling can cause motor failure.
- ❒ Check motor current. The amp draw should not exceed the nameplate rating.
- ❒ Check all wiring for secure connections or insulation breaks.
- ❒ Check the pump pressure and cutoff function.
- ❒ Check primary control safety lockout timing.
- ❒ Check ignition system for proper operation.
- ❒ Inspect the vent system and chimney for soot accumulation or other restriction.
- ❒ Clean the appliance thoroughly according to the manufacturer's recommendations.
- ❒ Check the burner performance. Refer to the section "Set combustion with test instruments".
- ❒ It is good practice to make a record of the service performed and the combustion test results.

- **Replacing the blower wheel:**

- When replacing the blower wheel, insure that the wheel is centered between the two sides of the burner housing as shown below.

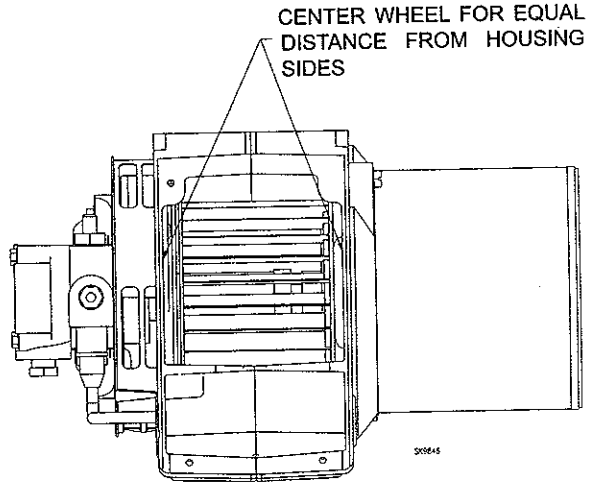
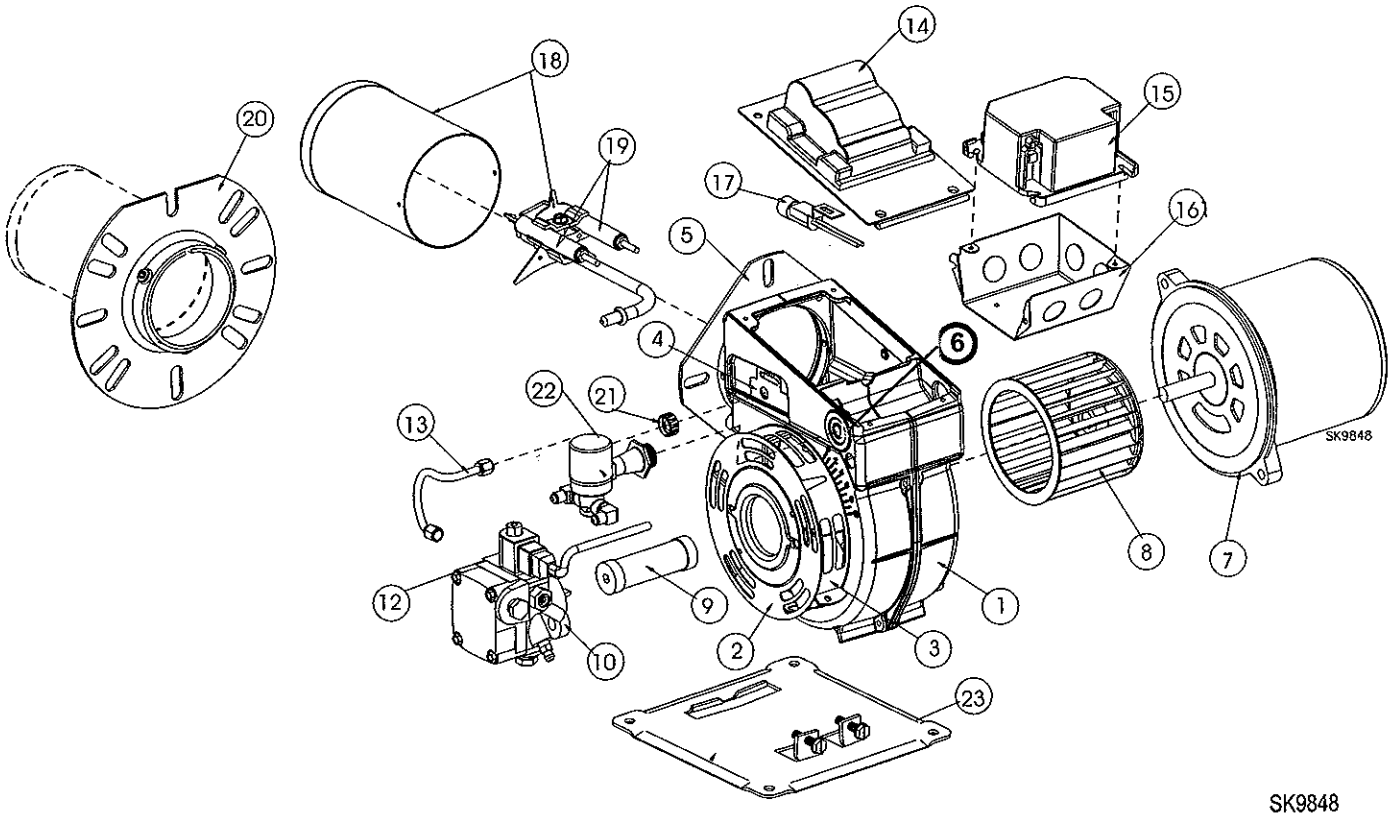


Figure 6. Blower Wheel Assembly

Burner Parts Diagram



For best performance specify genuine *Beckett* replacement parts

#	Part No.	Description
1		Burner Housing Assembly with Inlet Bell
2	3215	Air shutter, 10 Slot
3	3819	Bulk Air Band, 10 Slot
4	3493	Nozzle-line Escutcheon Plate
5	Specify ** 3399	Unit Flange or Square Plate
Not Shown	3416	Air Tube Gasket
6	2139	Hole Plug - Wiring Box
7	2900U 2364U	Drive Motor, 1/5 HP (SM Models) Drive Motor, 1/4 HP (SF Models)
8	2383U	Blower Wheel (6-1/4 X 3-7/16)
9	2433	Flexible Coupling (Fits 5/16" pump shaft)
10	 2591U 21188U	Fuel Units SF only Single-Stage 'A' Two-Stage 'B'
10	 2184404U 2460	Fuel Units SM only CleanCut Single-Stage 'A'
12	2256	Pump outlet fitting
	482	Pump holding screws (not shown)
13	5394	Connector tube assembly, pump to nozzle line

#	Part No.	Description
14	51824U	Igniter and Base Plate
14	2289U	Ignition Transformer (10,000 V/23mA)
15	7455U	R7184A - Interrupted Ignition
	7456U	R7184B - Pre-purge
	7457U	R7184P - Pre and Post-purge
	7458U	R7184P w/ Alarm Contacts
16	5770	Electrical Box
17	7006U	Cad Cell Detector
18	Specify **	Air Tube Combination
19	5780	Electrode Kit - F Head up to 9"
	5782	Electrode Kit - F Head over 9"
20	5432 3616	Universal Flange w/ Gasket Gasket Only
21	3666	Splined Nut
22	2182602U	Blocking Oil Solenoid Valve
23	5685	Base Pedestal Kit

** Contact your Beckett Representative for part number and pricing.

AIRDEX CORPORATION

AIR MAKE-UP UNITS

AMU Series

Construction
Welded steel housing finished in grey enamel.

Application
Available in a wide range of sizes handling 75 c.f.m. to 1100 c.f.m.

Designed to use as Air Replacement and Air Make-Up Units, for permanent installation.

To exhaust foul air and replace with fresh outside air.

By drawing on its wide range of tooled, standard parts, **Airdex** engineers can design a blower to meet your specific needs whether high or low air flow. AC motors, high or low resistance, single or double inlet.

Performance Data

			Air Delivery (CFM) at R.P.M. Specified							
Description	H.P.	R.P.M.	Free Air	1/8" SP	1/4" SP	3/8" SP	1/2" SP	3/4" SP	1" SP	1 1/4" SP
AMU 75	1/60	3000	75	61	54	43	-	-	-	-
AMU 130	1/70	1550	130	107	87	30	-	-	-	-
AMU 160	1/40	1600	165	150	135	120	104	-	-	-
AMU 245	1/20	1550	245	225	210	190	162	-	-	-
AMU 265	1/20	1610	265	250	233	215	185	-	-	-
AMU 400	1/12	1550	400	380	365	340	315	200	-	-
AMU 465	1/15	1530	465	430	397	357	308	-	-	-
AMU 525	1/4	1725	525	500	480	460	420	240	120	-
AMU 625	1/4	1725	625	600	560	540	500	420	280	100
AMU 845	1/2	1725	845	825	790	760	730	650	570	425
AMU 1100	1/3	1140	1100	1050	1000	950	B60	700	-	-

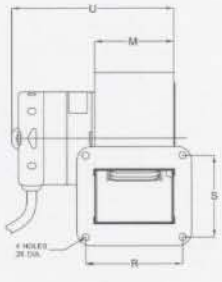
Tested by The Nozzle Chamber Method as directed in A.M.C.A. Bulletin #210. Figure #4.

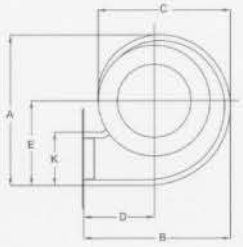
Features

115 Volt, 60 Hz

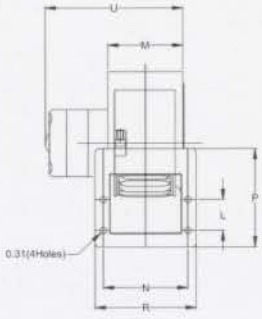
- Thermal overload protection
- Conduit wiring box
- Permanently lubricated bearings
- Horizontal or vertical operation
- Counter clockwise rotation drive side
- AMU 245, 400, 525, 625, 845 and 1100 supplied with inlet collars.
- Sleeve bearings with oilers
- 4 discharge positions

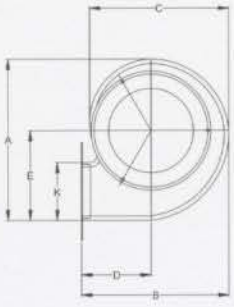
Specification Charts



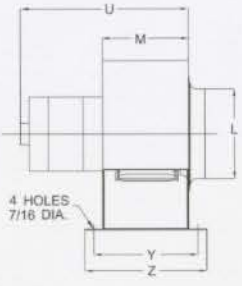


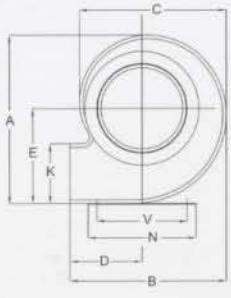
Description	A	B	C	D	E	K	M	R	S	U	Weight (lbs)
AMU 75	5.34	5.17	4.68	2.50	3.02	1.92	2.75	3.38	2.88	5.35	3.4
AMU 130	7.59	7.09	6.58	3.31	4.30	2.72	3.75	4.69	3.75	6.75	4





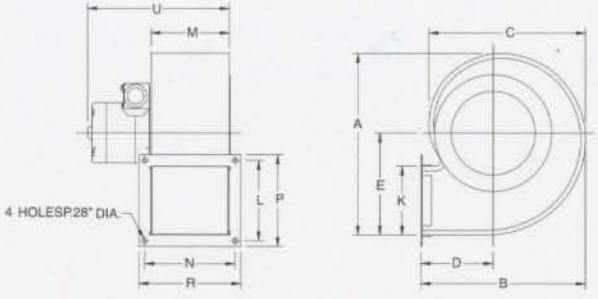
Description	A	B	C	D	E	K	L	M	N	P	R	U	Weight (lbs)
AMU 160	7.80	7.08	6.69	3.34	4.34	2.80	1.50	3.60	4.05	4.75	4.85	6.40	5.4



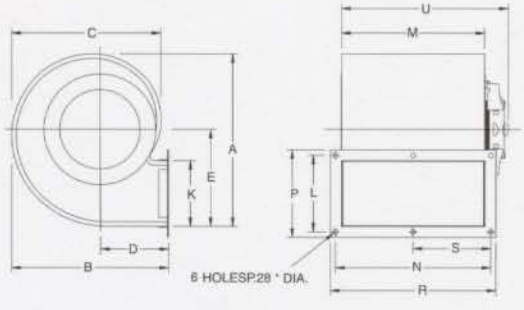


Description	A	B	C	D	E	K	L	M	N	U	V	Y	Z	Weight (lbs)
AMU 245	9.41	8.73	8.17	4.0	5.33	3.36	5.0	4.75	6.0	9.0	5.0	5.75	6.75	8
AMU 400	10.61	9.76	9.24	4.44	6.01	3.79	6.0	5.25	6.0	10.75	5.0	6.25	7.25	13

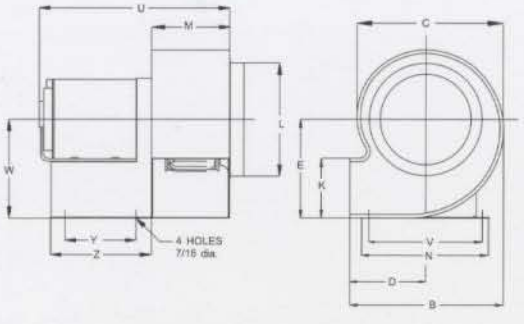
Specification Charts



Description	A	B	C	D	E	K	L	M	N	P	R	S	U	Weight (lbs)
AMU 265	9.93	9.0	8.46	3.9	5.55	3.75	4.37	4.22	4.87	5.0	5.5	-	7.65	8.05



Description	A	B	C	D	E	K	L	M	N	P	R	S	U	Weight (lbs)
AMU 465	9.93	9.0	8.46	3.9	5.55	3.75	4.37	8.12	8.82	5.0	9.4	4.41	9.46	11.0



Description	A	B	C	D	E	K	L	M	N	U	V	W	Y	Z	Weight (lbs)
AMU 525	11.91	10.85	10.36	4.88	6.98	4.24	8.0	5.5	9.0	13.6	8.0	7. 23	5.0	7.02	24
AMU 625	11.91	10.85	10.36	4.88	6.98	4.24	8.0	6.0	9.0	14.1	8.0	7.23	5.0	7.02	24
AMU 845	13.43	12.19	11.66	5.44	7.60	4.76	8.0	6.0	9.0	14.8	8.0	7.85	5.0	7.02	30
AMU 1100	16.58	14.62	14.06	6.34	9.51	6.28	9.0	7.0	9.0	16.6	8.0	9.81	5.0	7.02	53

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