WATER SUPPLY PIPELINE REPLACEMENT
CAPE DORSET, NU

OPERATIONS AND MAINTENANCE MANUAL

VOLUME 1 OF 1

Prepared for:
Government of Nunavut
Department of Public Works and Services
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GN PROJECT # 4-002-473
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December 16, 2002

1.0 INTRODUCTION

1.1 Project Title

WATER SUPPLY PIPELINE REPLACEMENT

CAPE DORSET, NU

Set No. ____ of 4

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1.2 Revision Data

Date	Description	Pages

1.3 Changes after Commissioning

Date	Change

1.4 Project Representatives

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3.0 DESIGN DATA

3.1 General

This section contains the predesign report entitled "Water Supply Pipeline Replacement, Cape Dorset, Nunavutt" as originally published. The page numbering, figure numbers, table numbers, headers, footers, and appendices are independent of this manual's organization.

Water Supply Pipeline Replacement Design Concept Brief, Cape Dorset, Nunavut

Draft Report
July 17, 2000

Water Supply Pipeline Replacement Design Concept Brief, Cape Dorset, Nunavut

Government of Nunavut
Department of Public Works & Services

00-7879-1000

Submitted by

Dillon Consulting Limited

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DILLON
CONSULTING

July 17, 2000

Government of Nunavut
Department of Public Works, & Housing Regional Office
P.O Bag 1000, Federal Building # 1531
Iqaluit, NT X0A 0H0

Attention: Salem Abushawashi, P. Eng.
Project Officer

Cape Dorset Water Supply Line Replacement

Dear Mr. Abushawashi:

Enclosed please find six (6) copies of the Concept Design Brief for the above project. This brief outlines the proposed works for the replacement of the pipeline in Cape Dorset. The schedule to complete this work needs to be finalized based on the current sea lift dates, and the available funding. Please provide use with the approved funding for this fiscal year.

The last sea lift to Cape Dorset is schedule to depart Montreal on August 16, 2000. To have any chance to make this departure, we recommend the material order for the pipe material be placed immediately. We suggest that two tenders be received on an invitational basis. On approval we will issue the tender documents to

- Urecon Insulation Ltd
- Thermal Pipe Systems Inc.

We trust that this document meets your approval. We will contact you on Tuesday to discuss the tender strategy.

Yours sincerely,
DILLON CONSULTING LIMITED

Gary Strong, P.Eng

Project Manager

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1.0 INTRODUCTION

The Department of Public Works and Services (DP&S) of the Government of Nunavut set the replacement of the water supply line in Cape Dorset as a priority in the fiscal years 2001 & 2002. The existing pipeline has experienced problems over the past decade related to corrosion, freezing, and failure of the Victaulic connections. In January 1997, Reid Crowther & Partners Limited (RCPL) completed a planning study of the water supply system in Cape Dorset entitled "Water Supply Pipeline Planning Study, Cape Dorset, NWT" that describes these concerns

Dillon Consulting Limited was retained in July 2000 to complete the design of the replacement of the water supply pipeline. The scope of work for this assignment as outlined in the terms of reference issued by DPW&S, and is as follows;

- "Provide Architectural and Engineering services to review the attached (sic) planning study by RCPL and its recommendations, perform necessary community visits and investigations, liaise with the community representatives, provide options and class A estimates for the required upgrade, and provide design and tender package for the necessary upgrade/replacement to the water supply pipeline and ancillary infrastructure as directed by the client/project officer."

This report develops the requirements of the proposed upgrades to the pipeline system. The design horizon has been set at 20years based on the commissioning date of 2001, therefore the design year is 2021.

2.0 EXISTING SYSTEM DESCRIPTION

The existing pipeline was installed in 1973 (RCPL). The pipeline was modified in 1994 with the installation of the of a new Truck Fill Station (TFS). Improvements were also made to the pipeline in 1985 with the replacement of pipe supports in some sections. The pipeline consists of the following components (see figure 2.1 for a layout of the pipeline, and figure 2.2 for the schematic drawing) of the raw water supply system.

- The intake pump is located in Tees Lake. The pump is controlled based on the level of water in the storage tank at the TFS.
- A junction box located at the head of the intake is used for electrical connection for the intake pump and intake heat trace.
- The pipeline from Tees lake to the Heater House operates as a pressure line. The line is 65 mm galvanized steel, c/w heat trace and insulation.
- The Heater House contains three emersion heaters, a head tank, electrical and controls
- The pipeline from the heater house to the TFS is a gravity line, 75 mm galvanized steel, heat traced and insulated.

The operation of the pipeline is as follows;

- Low water level in the storage tank at the TFS calls the system into resupply mode.
- The heat trace in the pipeline are energized for approximately 1 hour to preheat the pipe

and thaw any pieces of ice that may exist in the line,
- Control Valve (CV) 3 opens, CV4 closes
- The intake pump is energized and water flows to the heater house,
- The emersion heaters are energized, and are also controlled by a level controller in the emersion tanks. The emersion heaters will not operate in a low water event.
- Water flows through the emersion heaters to the head tank.
- The head tank provides for a balancing between the pressure flow to the heater house and the gravity flow to the TFS. The head tank is vented to atmosphere, and therefore negative pressures in the head tank can not occur.
- Water flows to the TFS through the gravity line,
- Water fills the Storage Tank
- High water level in the Water Storage Tank initiates the shut down sequence,
- The intake pump is de-energized,
- The emersion heaters are de-energized,
- The pipeline from the Heater House to Tees Lake is drained by gravity to Tees Lake,
- CV 3 closes,
- CV 4 opens,
- The pipeline from the heater house to the TFS is drained by gravity to the drain tank. Pump (P) 3 and P4 are used to empty the drain tank into the Water Storage Tank.
- The heat trace remains energized for approximately 1 hour after the intake pump is de-energized.

3.0 SITE INSPECTION

On June 28 to 30 an attempt was made to complete the site investigation. Due to poor weather in Cape Dorset, the investigation was delayed until July 4th and 5th. The site inspection was completed by Ms Tanya Smith, P. Eng, Dillon Consulting Limited. The following are the observations made during the investigation. Photos of the system are shown in Appendix A.

- Wood supports are ~2.8 metres apart, steel supports ~3.0 metres apart on average. (See Photo 1)
- Wooden supports are not in bad condition considering their age. (See photo 2)
- Frost jacking affects about 11 steel supports, 3 welded together and one independent one in a marshy area have moved upwards so the remaining ones in the area have been shimmed to maintain the proper grade on the pipeline (See photo plate 3). The pipeline is not back graded here.
- There doesn't appear to be any back graded pipes on the entire line, they have never experienced freeze ups except near the truck fill station due to the line not being drained. The line is check annually for proper grade with a level.
- Transition to steel piles is just prior to frost jacked problem area. About ½ of pipeline is on steel supports, including between heater house and lake.
- The Hamlet reports that they haven't had problems with the intake. The pump was replaced approximately 4 years ago.
- Heater house building can be re-used with some modification namely a new door (see photo 7) and maybe some repairs to the insulation.
- Junction box at intake needs to be replaced due to age and damage. (See photo 9, 10)

- The pipeline connection to the truck fill can be just inside the building, (see photo 10). If a re-alignment is done the municipality suggests connecting it to top of tank.
- Inside truck fill is 75 mm copper, after black iron 'Y'. (see photo 10)
- An alternative alignment is over bedrock outcrop, which would result in some very steep sections. All supports are wooden in the lower half of the line and could not be reused in the new alignment.
- A few late season crossings would prevent some damage due to traffic in the spring.
- There is no road to the top of the pipeline. There are many washed out sections in spring till mid July. The Heater House only be accessed via ATV or snowmobile. Hauling any equipment would be difficult as there are many steep, muddy, and rocky sections. Site work could get really expensive. Cape Dorset doesn't have good supply of granular. Using tracked equipment is an option.

As part of the site inspection the Hamlet representatives were interviewed to understand their concerns, and to identify any problems with the existing system. The representative from the Hamlet was Bob Wortman, Director of Housing and Public Buildings The following comments were received from the community.

- The Hamlet suggests the pipeline should be anchored to the hill in a few places, now it is not. The Hamlet fears the pipe will slide down the hill while they are working on it or in the event of a break.
- Major concern of Hamlet is ease of use of heat trace. They want to be able to do all repairs themselves. Pulling 500' sections of heat trace to work on pipe is difficult. The Hamlet doesn't prefer the heat trace that sits inside the pipe.
- The Hamlet would favour plastic pipe laid on ground. Copper would also be easy for them to work on. They have concerns about corrosiveness of water with respect to copper.
- The existing couplings are rusting badly. From this experience the Hamlet thinks flanged pipes would be better.
- The Hamlet suggests burying the pipe in the area used for ATV crossing.
- Some steel supports are falling over between the heater house and the lake. The Hamlet placed additional wood cribbing, but these are now in poor shape.
- Ice chunks can be heard travelling through pipe in winter. The Hamlet is concerned with blockages where there are corners in the pipeline.
- The Hamlet would like to see dual pumps at the intake in the new system
- The Hamlet would like to see removable pipeline insulation to make the pipeline easier to work on.
- The Hamlet suggests the use of flanged joints to facilitate repairs,
- Eliminate the areas that have minimal vertical grade
- The Hamlet suggested the use of self limiting heat trace that would only come on when needed and may eliminate the need for the emersion heaters in the heater house.
- A service road to the heater house would be beneficial
- The existing pipeline should be retained for emergencies
- The energy consumption of the system as a whole should be minimized.

The Hamlet provided a list of issues (summarized above), water temperature data, heat trace and power supply sketch, and some material quotes. These are included in appendix B.

4.0 POPULATION AND CONSUMPTION PROJECTIONS

The population projection for the community of Cape Dorset are based ion the information provided by the GN department of Statistics. These numbers are generated for all communities in Nunavut. Consumption is based on the following formula;

Per capital Consumption = 90 litres per day * (1 + .00023 * population)

Based on the above the following table shows the projected consumption and population for the community over the design horizon.

Table 4.1
Population and Consumption Projections

Year	Population	Daily Consumption (m^3/day)
2,000	1,213	140
2,005	1,354	160
2,010	1,501	182
2,015	1,662	207
2,020	1,829	234
2,022	1,900	246

The 20 year design average daily consumption is 246 m^3/day. The system has a water supply tank that meets the emergency and fire flow demands. As such the average daily consumption is set as the design requirement for the system.

5.0 PIPELINE HYDRAULIC REQUIREMENTS

The existing pipeline capacity is based on the maximum flow rate in the gravity line from the heater house to the TFS. This rate is the limiting rate for the system.. The pumping rate from the intake to the heater house can be increased by the use of larger pumps, but if this rate exceeds the gravity flow rate, the excess water would be discharged through the over flow on the head tank. Therefore the pumping rate should be set to be slightly less than the gravity flow capacity of the line from the heater house to the TFS. Based on a 75 mm line the gravity flow rate is calculated as follows;

$$Q_{max} = \frac{A*R*2/3*S1/2}{n}$$

Where A = cross sectional area = 0.0045 m^2
R = Hydraulic Radius = 0.0191 m
S = Slope = 11.5%
n = mannings "n" = 0.020

Q_{max} = $\{0.0045 * (0.0191)^{2/3} * (.115)^{1/2}\}/.020$
= 0.00545 m^3/sec, or
= 5.45 l/s

Based on a 24 hour pumping period the maximum water supply to the community would be;

$V_{daily\ max}$ = $\{5.45 * 60 * 60 * 24\}/1000$
= 470 m^3/day

For a 50 mm pipeline the $V_{daily\ max}$ is 154 m^3/day

For a 65 mm pipeline the $V_{daily\ max}$ is 300 m^3/day

The design daily $V_{daily\ max}$ is 246 m^3/day at teh 20 year design horizon.

The above calculations do not include the provision for the loss of flow related to the presence of the heat trace in the pipeline. We recommend that a 75 mm gravity line be used for this project.

6.0 HEAT LOSS CALCULATIONS

The heat loss of the pipe gas been calculated using five scenarios. The full calculations are shown in Appendix E. The assumptions for the calculations are;

Heat Loss G = Q*C*R

Where Q = Flow in m^3/sec
C = Heat capacity of Water
R = Thermal resistance of Pipe and Insulation

The Scenarios and the results are tabulated below.

Table 6.1
Heat Loss Summary

Scenario	Insulation Thickness (mm)	External Air Temperature (°C)	Water Temp at Lake (°C)	Water Temp at Heater House (°C)	Water Temp at Truck fill Station (°C)
1.0	25.0	-50.0	4.0	3.83	2.30

Scenario	Insulation Thickness (mm)	External Air Temperature (°C)	Water Temp at Lake (°C)	Water Temp at Heater House (°C)	Water Temp at Truck fill Station (°C)
2.0	50.0	-50.0	4.0	3.90	2.97
3.0	25.0	-50.0	0.5	0.34	-1.90
4.0	50.0	-50.0	0.5	0.40	-0.46
5.0	50.0	-25.0	0.5	0.42	0.01

The above assumes that there is no heat sources in the system, IE both the heat trace and the emersion heaters are turned off. The addition of the heat trace system (in pipe at 3.6 w/m) would result in an increase of the water temperature by 0.5 °C. In other words, with the heat trace on, the resultant temperature of scenario 4 would be slightly above 0 °C.

Based on these calculations, it is recommended that the pipe line have 50mm of rigid foam insulation. Further, the system be operated without the use of the emersion heaters, unless the temperature of the outside ambient air is below 30 °C. The system should be operated at these temperatures and monitored to verify that the calculations are modeling the actual performance.

7.0 UPGRADING REQUIREMENTS

7.1 General

To review the requirements of the upgrade, the system has been divided into the following components

Tee Lake Intake

Pipeline from Tee Lake Intake to Heater House and from Heater House to the TFS

Heater House

Truck Fill Station

The following sections discuss the requirements of the system, the required upgrades, the options available for the upgrade and the analysis of the options.

7.2 Tee Lake Intake

The intake consists of;

- An intake screen. The screen has not been inspected, and this work is beyond the scope of work. There have been no reported problems with the scree. No action is required.

- The casing pipe (100 mm). The pump is a submersible well type with foot valve removed . The pump and discharge hose is placed inside the casing pipe to facilitate removal of the pump for inspection and replacement. The Hamlet indicated that the casing pipe has no reported problems and can remain in place.

- The Pump. The O&M Manuals show the intake pump to be Red Jacket 80 GPM 4EC, 2 h.p., 208, 3 phase. The casing pipe is anchored to the shore.

  The pump was replaced about 4 years ago, and there are no reported problems with the new pump. Pump replacement should be completed on a maintenance basis, there is no cause to replace the pump as part of the current project.

- The Hamlet expressed the desire to have a duplex pumping system at the intake. To facilitate this request, a second intake casing would be required. The new intake casing and the old casing can be connected using a "Y"type ball valve.

  The cost to install a new intake c/w pump, heat trace, screen and "Y" ball valve is estimated to be $75,000.

- The junction box located on land near to the intake. The primary use of the junction box is to allow for the connection of the heat trace for the intake to be connected to the electrical power. The junction box is in a state of disrepair and requires replacement as part of this project.

  The replacement junction box can be made of similar construction to the existing junction box. The existing box provided over 20 years of service with no major concerns. The replacement junction box is estimated to be $10,000.

7.3 Pipeline from Tee Lake Intake to Heater House and from Heater House to the Truck Fill Station

As stated the pipeline from the intake to the heater house is a 75 mm insulated line, and from the heater house to the TFS it is a 65 mm insulated line. Each component of the pipeline needs to be reviewed for reuse, design requirements, and material selection.

Pipeline Supports

The pipe supports between the heater house and the Tee Lake Intake were originally placed with the construction of the pipeline in 1973. The supports were replaced in 1985 with steel pile supports. The supports in this section are in sound condition and can be reused for the new pipeline. The new pipeline can be installed parallel to the existing pipeline on the steel supports

The Pipe supports from the heater house to the TFS are a mix of steel supports and wood supports. The wooden supports provide adequate support at the present time. However the age of the supports suggests that they need to be replaced with the installation of the new system.

The steel supports are in sound condition. Some along the length require adjustments due to the

movement of the supports over time (see photo 3). The improvement to the supports should be completed as part of the new system.

Heat Trace System

The design of the original heat trace was to provide pre-warming of the pipe prior to pumping, freeze protection during pumping, and residual heating after the pumping cycle. The design was for a pipeline with a total length of approximately 2,000 metres. The current pipeline is approximately 1,200 metres. With the installation of the new pipeline the heating requirements and heat trace installation needs to be revisited.

Section 5.0 describes the heat loss for the proposed pipeline. The heat loss calculation suggest that a heat trace system that provides approximately 11.8 watts/metre (w/m) (3.6 w/ft) is adequate. This is on the assumption that the heat trace is placed inside the pipe. If an external heat trace (IE a heat trace placed between the pipe and the insulation) is used, the required heat supply would be 20 w/m. The increase in the required heat load is based on a less efficient heat transfer that occurs with the external heat trace system.

The capital cost for the heat trace system regardless of internal or external installation is similar. The annual cost to operate the external is approximately $30,200 per year higher than the internal system. This is calculated as follows;

Difference in power requirements(20 w/m - 11w/m)	9 w/m
Length of heat Trace	1,200 m
Total increased power draw	10.8 kW
Operating time (approximately 50% of year)	4,000 hrs per year
Total Power Consumption	43,200 kWh
Cost for power	$0.70/kWh
Cost per year	$30,200
Cost over 20yrs at 8% discount rate	$296,000

Since the operational cost of the system is of concern, the in-pipe heat trace system is recommended.

The current operational practice of the heat trace does not require sophisticated controls. It is recommended that the system be maintained at a low technology level. The heat trace system will therefore have the flowing components;

- Mineral Insulated heat trace cable CSA approved for in pipe use. 600 volt power source.
- The cable lengths will be 70 m (230ft).
- 9 power points will be required along the pipe length. This are similar to the existing system power points
- No solid state controllers will be installed. The cables will operate on an on/off basis.
- On/Off control will be from the Water Storage Tank level controllers and timers. The addition of an ambient air sensor to prevent the use of heat trace in the summer will be implemented.

The supply cost for the heat trace system is $38,000.00 FOB Cape Dorset. The installation cost is carried under the pipe installation below. The Heat Trace system is shown, complete with a quote, in appendix C.

Pipeline

The pipeline line is to be replaced due to the corrosion of the line and failure of the joints. Options for replacement are shown in table 6.1. The criteria for the selection of the material is based on the cost to construct, the ease of maintenance, the ability of local forces to complete construction and repair works, the life expectancy of the pipeline, the suitability of the material for the intended purpose.

Table 7.1
Pipeline Options

Material Type	Estimated Cost	Local Forces	Heat Trace	Life Expectancy	Suitability for purpose
Copper Pipe Screwed Fittings	Pipe Supply $108,000 Shipping $3,400	Construction can be completed by local forces Maintenance can be completed by local forces	Either in pipe or external heat can be used	20 years	Good. Corrosion is expected to effect pipe.
Cooper Pipe Flanged Fittings	Pipe Supply $170,000 Shipping $3,400	Construction can be completed by local forces Maintenance can be completed by local forces	Either in pipe or external heat can be used	20 years.	Good. Corrosion is expected to effect pipe life.
HDPE Fused Fittings	Pipe Supply $104,000 Shipping $3,400	Construction cannot be completed by local forces Maintenance can be completed by local forces. Requires the use of specialized equipment	Only external heat trace can be used. Less effective, can not be used to thaw frozen pipe	Concerns with heat trace. 5 to 10 year life expected	Poor. Concerns with heat trace exclude the use of HDPE. Heat trace suppliers have recommended against the use heat trace with the expected operating conditions of the pipeline.
Stainless Steel welded joints	Pipe Supply $164,000 Shipping $3,400	Construction can not be completed by local forces. Maintenance can be completed by local forces.	Either in pipe or external heat can be used	Life expectancy is 40 years	Excellent

The above indicates that the use of copper pipe will not result in a pipeline life expectancy greater than the existing galvanized steel pipe. We have discussed the use of the copper pipeline life expectancy with the Canadian Copper and Brass Development Association, Mr. John Catterall, Technical Manager. Their files indicate that the corrosive nature of the Cape Dorset water, the use of heat trace, and the intermittent use are of concern, and that the copper line

would not be expected to pre form better than galvanized steel pipe line (see letter in Appendix D). The existing galvanized steel piping provide adequate service for approximately 20 years, so this is set as the life expectancy of the copper pipeline.

The life expectancy for Stainless steel is approximately 40 years. The installation costs for one type of piping is not expected to be significantly different from that of any other type of piping. To compare the life cycle cost of the stainless steel to the copper line or galvanized steel line the life expectancy for both systems must be equal. One method to assess these options is to assume that the copper line would need to be replaced in 20 years. The present value of the installation of a new line in 20 years to replace a copper line and the present value of the installation of a stainless steel line area shown below.

Material Type	Materials	Installation	Total Capital	20 year replacement cost	Present Value of replacement (8%)	Total Present Value
Copper	$114,000.00	$120,000.00	$234,000.00	$234,000.00	$50,000.00	$284,000.00
Stainless Steel	$167,400.00	$120,000.00	$287,000.00	$0.00	$0.00	$287,000.00

From the above the is no significant difference in the life cycle cost between the copper pipe installation and the stainless steel installation.

For the purpose of comparison, the use of HDPE pipe is assessed against the stainless steel pipe. This comparison assumes that an external heat trace system is used, and that the HDPE pipe provides 40 years of service. As stated previously, HDPE is not recommended because of concerns with the use of heat trace, the intermittent use, and the potential for the heat trace to melt the pipe.

Material Type	Materials	Installation	Total Capital	Additional cost of heat race power supply (yearly)	Present Value of replacement (8% at 40 years)	Total Present Value
HDPE	$108,000.00	$120,000.00	$228,000.00	$30,200.00	$359,000.00	$588,000.00
Stainless Steel	$167,400.00	$120,000.00	$287,000.00	$0.00	$0.00	$287,000.00

From the above, it can be seen that the increased cost of using the external heat trace system over the 40 year life of the pipeline is significant and that over the life of the pipeline the stainless steel line is more economical.

In earlier reports (RCPL) the use of aluminum was identified for further analysis. The aluminum line would provide the same service life as stainless steel, and at a comparable cost. However, there is concern with the presence of aluminum in potable water. Aluminum has been related to diseases such as Alzheimer's. There is insufficient water quality data to assess the final level of aluminum in the Cape Dorset water. Further, it is expected that future Drinking water Guidelines will lower the acceptable amounts of aluminum in drinking water. For these reasons,

aluminum piping is not recommended for evaluation.

The use of stainless steel pipe is recommended for this project.

7.4 Heater House

The heater house has the following components.

- Build foundation and envelop. Both are in reasonable condition and can be reused in the new system. The door of the building needs to be replaced.
- The building piping and mechanical works are shown in figure 2.2. The emersion heaters and head tank are is sound condition and can be reused in the new system. Based on the heat lose calculation shown in section 5.0, the emersion heaters are not required on a daily basis. Maintaining these heaters for stand by use is recommended. The controls for these heater needs to be modified to reflect the new operational sequence.
- Monitoring and controls for the heat trace system from the heater house to the intake, and from the heater house to the mid way point to the Truck Fill Station. These controls will need to be replaced with the installation of the new heat trace system. As discussed the controls for the new heat trace is to be minimized.
- Power supply to the heat trace, emersion heaters and building domestic electrical (heaters and lights). Due to the magnitude of the upgrade, all electrical will need to be brought to current codes. We recommend changing all power panels, control panels, and electrical devises as part of the upgrade.

7.5 Truck Fill Station

The TFS was constructed in 1994. There has been only two issues of concern identified with respect to the pipeline operation and the TFS, these are;

- When the filling operation is interrupted by a power failure, the system returns to a standby mode. This can result in the freeze up of the pipeline. The start up after a power failure needs to be changed to "Draining the Pipeline" mode. This is a change in the controls and can be completed as part of this project.

- The Hamlet has request that the option of filling the storage tank from the top be investigated. This arrangement is possible. The pipeline would need to be realigned on to the hill behind the tank, and then a piping bridge constructed from the hill to the top of the tank. The piping bridge is needed to support the pipeline. The bridge would need to be approximately 50 m. To complete this work would require very few changes to the Truck fill Station. The drain tank would still be required to drain the truck fill arm. A blind flange would be required at the location that the pipeline ties into the truck fill Station piping.

  The cost of this new piping bridge and the modifications to the Truck Fill Station is estimated to be $30,000 to $40,000.

7.6 Upgrade Summary and Conclusions

The following is the summary of the upgrade to be completed on the Cape Dorset Water Supply line.

Upgrade Description	Cost Estimate
Replacement of the pipeline from the top of the intake to the Heater House, and from the heater house to the TFS	$287,000.00
Installation of an in-pipe heat trace system	$38,000.00
Upgrades to the Heater House Door	$2,000.00
Replacement of the Intake Junction Box	$5,000.00
Upgrade of the Electrical &Controls	$25,000.00
Total	$357,000.00

The above numbers do not include GST, contingency and engineering

8.0 IMPLEMENTATION

The current budget for this project is $_____. Based on the available funding it is suggested that material supply be completed this year, as well as a portion of the construction. The remainder of the construction is to be completed in the following fiscal year. To meet the 2000 Sea Lift dates, a material supply tender should be issued prior to _____ for closing the tender period on or before_____. Material order is six weeks. Based on these criteria, the following Schedule is proposed.

Pipeline Materials

Approval to Proceed with Tender of Materials	July 18, 2000
Tender for Material Supply for Pipe	July 21, 2000
Close For Material Tender	August, 2000
Shipment to Site	September, 2000

Documentation

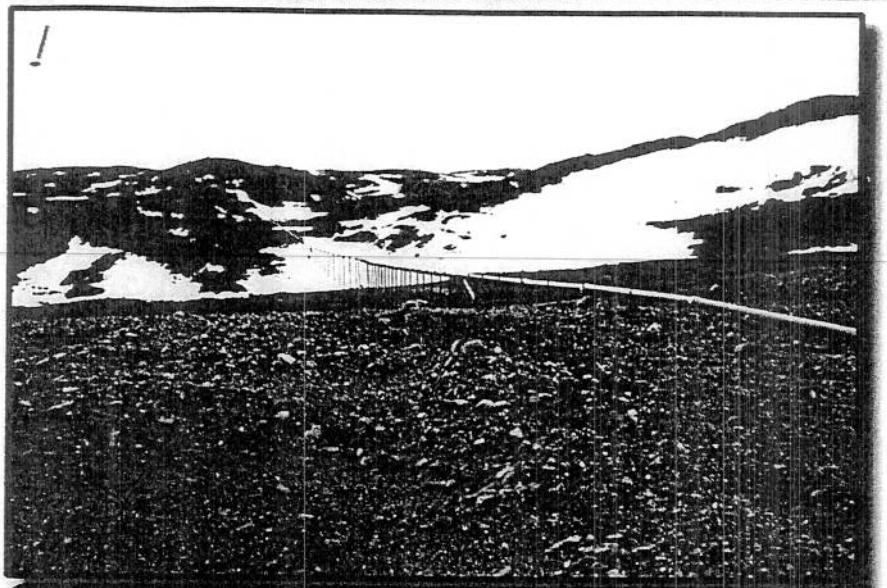
Completion of GN review of Concept Brief	July 21, 2000
Finalize Concept Report	July 31, 2000
Completion of construction tender Documentation	August, 24, 2000
Tender Period for Construction Contract	August 24 to September 14, 2000

Construction

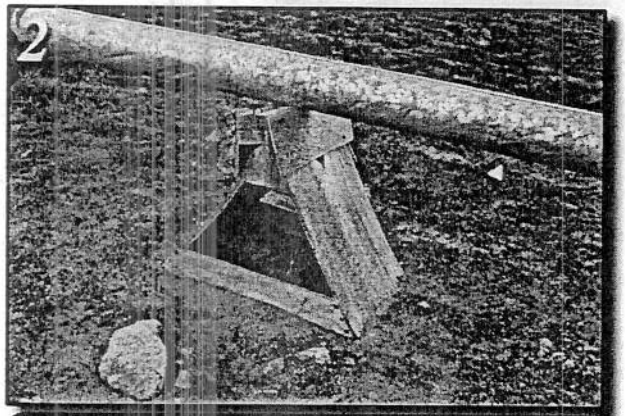
2000 Construction	October 2000
2001 Construction	June to August, 2001
Commissioning	August 2001

Appendix A
Photo Plates

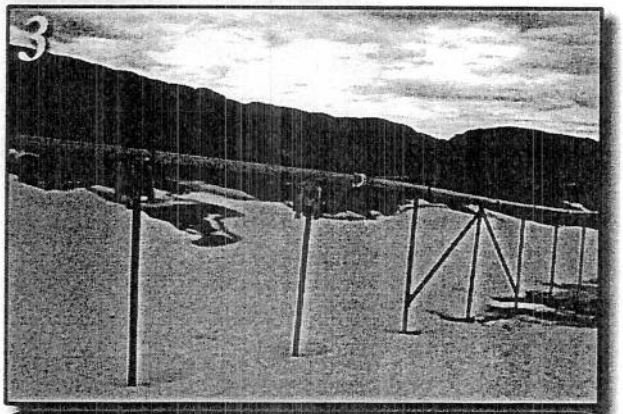
Photo Plate 1



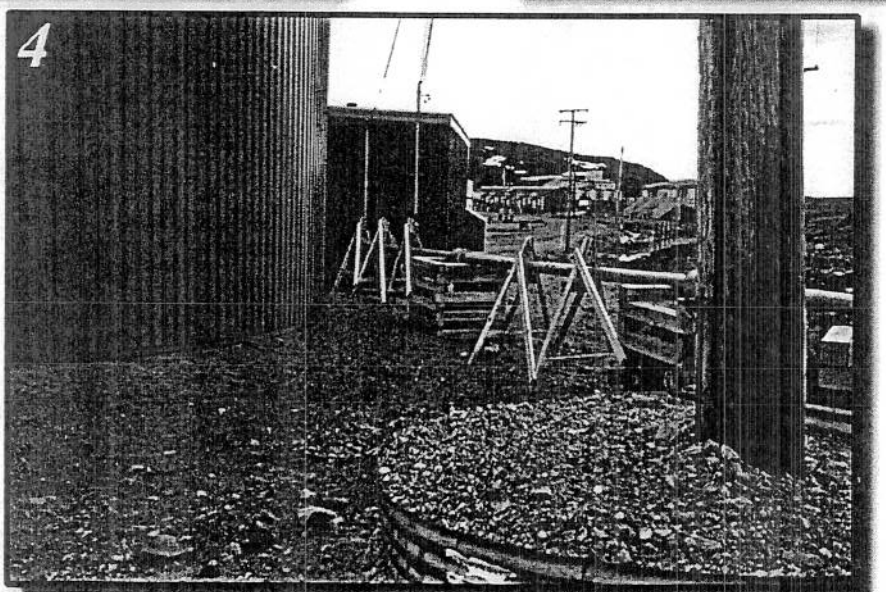
Steel supports



Wood supports

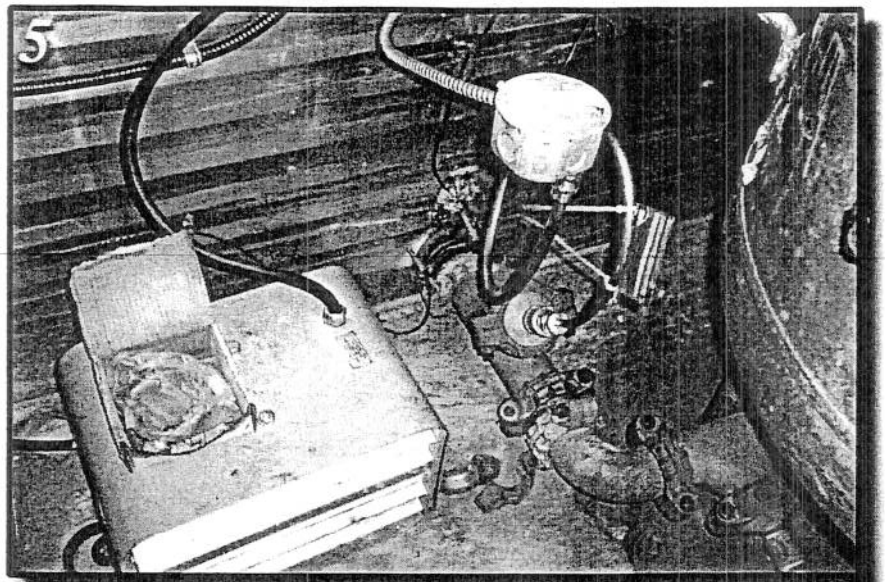


Shimming of steel supports

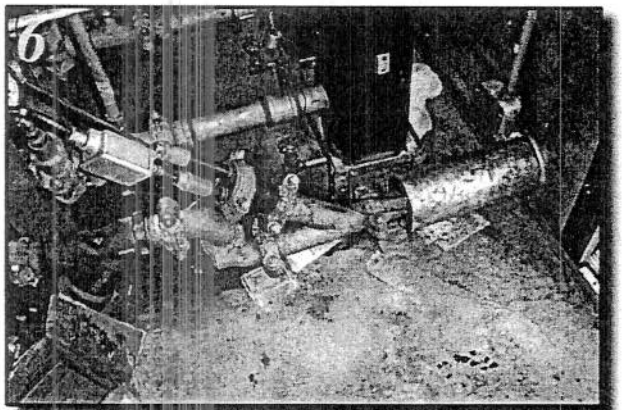


Wood supports at Truckfill station

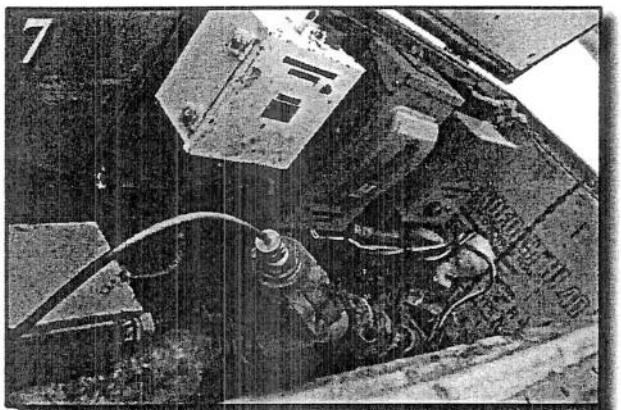
Photo Plate 2



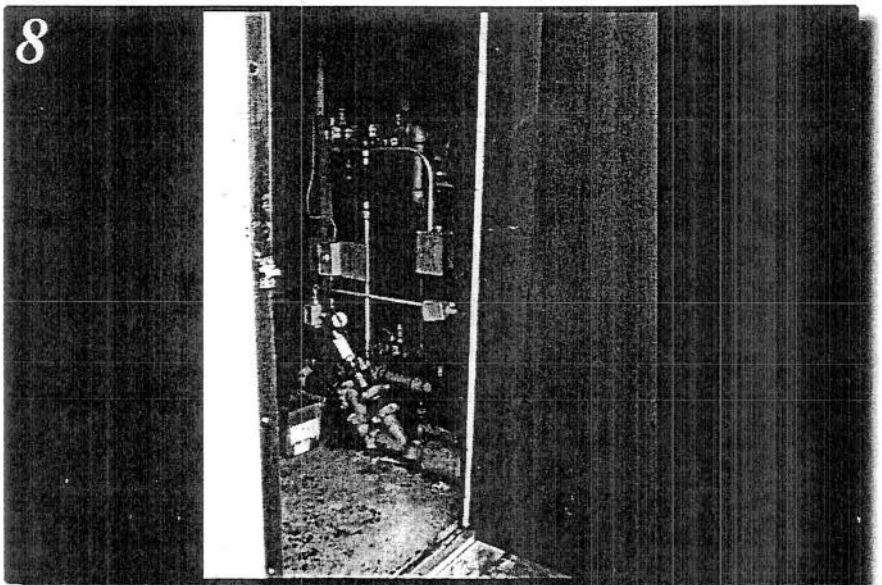
Piping to TFS



Piping to Intake

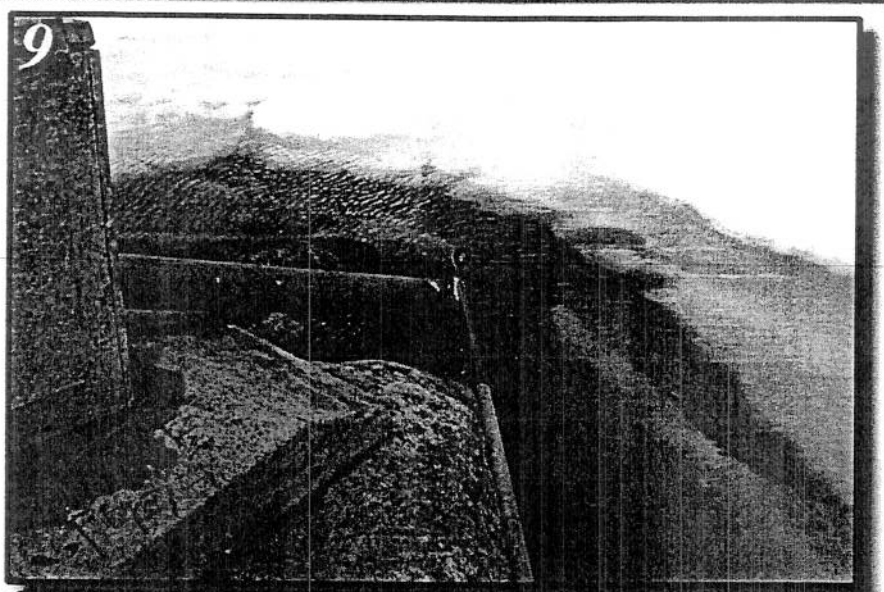


Heat trace in section

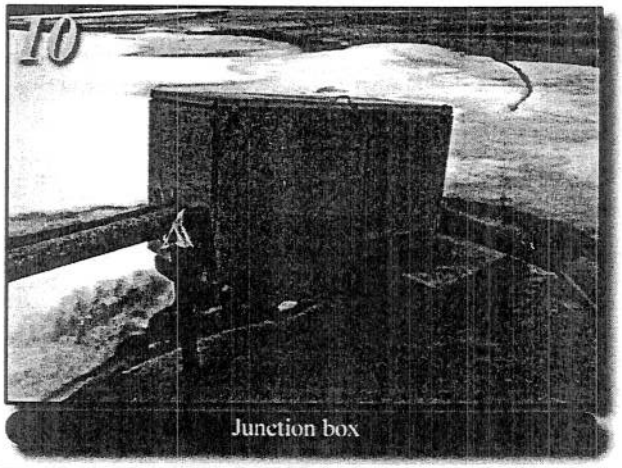


Door

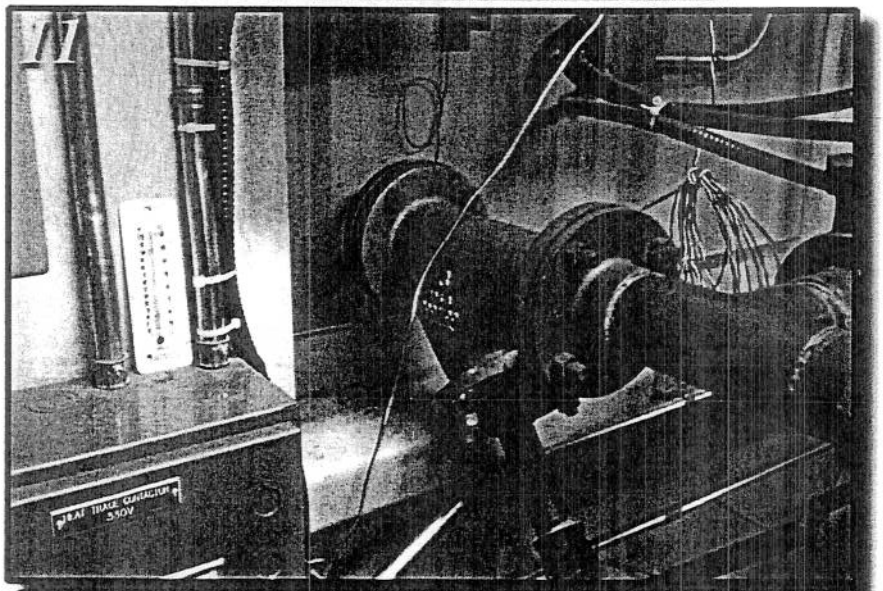
Photo Plate 3



Intake & junction box



Junction box



Piping in TFS

Appendix B
Hamlet's Submission

Table of Contents

1. New Pipeline / Water Supply Suggestions and Concerns.
2. Water Temperature Data.
3. Heat Trace and Power Supply Sketch.
4. Summary of Suppliers, Materials, and Prices.
5. Supplier Quotes and Product Information.

Post-it™ Fax Note 7671	Date	# of pages ▸ 5
To GARY	From	
Co./Dept. Info from	Co. Cape Dorset	
Phone #	Phone # Municipal	
Fax #	Fax # Staff	

March, 4,1998

New Pipeline / Water Supply Suggestions and Concerns

1. Dual pumps of greater pumping capacity in lake.
2. Support system must be upgraded in areas and replaced in others.
3. Heat Trace located inside the pipe makes maintenance difficult. Heat Trace must be removed in order to replace or repair pipe, gaskets, couplings, etc... The type of Heat Trace currently in use is quite fragile and once damaged not repairable (some lengths may be repairable if shipped back to the factory). This Heat Trace is also more difficult to make connections and if great care is not taken in making connections failure will result, if the Heat Trace works at all.
4. We would like to see the Heat Trace installed on the outside of the pipe to facilitate easy maintenance of both Heat Trace and pipeline.
5. Insulation should the removable type with strapped on metal covering.
6. Flanged joints.
7. Eliminate areas of low grade.
8. Suggest the use of self-regulating external heat trace which only draws enough current to maintain temperature above freezing. This type of heat trace would eliminate the need for the heaters at the top of the hill.
9. Installation of monitoring equipment, which could activate alarms or turn on or off heaters, heat trace, pumps, etc... if certain conditions exist.
10. This external heat trace could be used to thaw pipeline in the event of a freeze up.
11. New service road would be needed.
12. Retain old pipeline to be used as back up. The new pipeline would be able to share the existing steel supports at the top of the hill.
13. With properly insulated pipe, heating of the water on its way down the hill may not be needed at all. More study of existing conditions should be done to confirm or disprove this idea.
14. Stainless steel pipe would of course be our first choice of pipe but due to cost HDPE should be looked into in greater detail.
15. More information must be gathered and different ideas developed regarding pipe type and size, the need to heat the water or not, a monitoring system to control heat trace or heaters or a combination of the two.
16. Cost analysis of installations of different types and the utility costs and maintenance costs involved with each should be the next step
17. Anchors to hold pipeline at areas of high grade.
18. The possibility of terminating the pipeline at the top of the tank should be explored.
19. Move the course of the pipeline in closer to the hill to decrease overall length and offer better protection.
20. Provide crossing sites at relevant locations.
21. Reduction of energy consumption on complete system.

I would be happy to collect any type of data required if advised of what would be beneficial.

Bob Wortman,
Foreman, Dept. of Housing and Municipal Works, Cape Dorset, N.W.T.
Ph. 897-8878

WATER TEMPERATURES

WIND	TEMP.	DATE
15 KM/H	-26 C	FEB.23

AT HEATER HOUSE

BUILDING TEMP. 42 F

UPON START UP		1ST	2ND
IMM. HEATER # 1	TEMP. IN	47 F	42 F
	TEMP. O T	60.5 F	58 F
IMM. HEATER # 3	TEMP. IN	45 F	41 F
	TEMP. OUT	55.5 F	49 F
COMMON THERM.		60 F	47 F
IMM. HEATER DRAIN			34.1 F 32.4 F 32.8 F
VENT TANK		41.4 F	39.7 F 39.4 F 39.5 F

AFTER CALIBRATION

		1ST	2ND
IMM. HEATER # 1	TEMP. IN	38 F	
	TEMP. OUT	47 F	
IMM. HEATER # 3	TEMP. IN	37 F	
	TEMP. OUT	44 F	
IMM. HEATER # 1 DRAIN		34.3 F	
VENT TANK		39.3 F	
COMMON THERM.		40.5 F	

WATER TEMPERATURE AT TRUCKFILL STATION

5 GALLON PAIL OF WATER FROM PIPELINE 39 F

WE WILL CONTINUE TO COLLECT DATA ON WATER TEMPERATURES
WE WILL ALSO OBTAIN TEE LAKE WATER TEMPERATURES
THE THERMOMETER READINGS EVEN AFTER CALIBRATION ARE STILL INCONSISTENT

PIPELINE REPLACEMENT CAPE DORSET

MATERIALS

SUPPLIER	DESCRIPTION OF ITEM	PRICE
KEVIN HUNTLEY WELDING	304 STAINLESS STEEL 3" PIPE SCH 40	$126,715.00 FOR 5000'
BARTLE & GIBSON	HDPE 3" PIPE	N/A AT PRESENT
WESTBURNE	GALVINIZED STEEL PIPE 3"	$74,482.29 FOR 5000'
WESTBURNE	RAYCHEM 5BTV 240V HEAT TRACE	$38,580.95 FOR 5000' INC. CONDUIT TRAN
DREXEL WESTERN	RAYCHEM 5BTV2-CT HEAT TRACE	$23,591.1 FOR 5000' HEAT TRACE ONLY
BARTLE & GIBSON	THERMON RSX-R-2-BNOJ	$46,671.18 FOR 5000' INC. CONDUIT, TRAN
ALBRICO SERVICES	PIPE INS. 2"URETHANE W/ 30G CLADDIN	$132,435.00 FOR 500 INCL. LABOUR
CANTECH	HEAT TRACE CONTROLLERS	$7,941.17 FOR 3
DREXEL WESTERN	HEAT TRACE CONTROLLERS	$3,000.00 FOR 3
STOWELL ENTERPRISES	SUBMERSIBLE PUMP 170 US GPH	$2800.00 EACH PUMP ONLY

THE ONLY LABOUR COSTS INCLUDED ARE FOR THE INSULATING JOB ALL PIPELINE ASSEMBLY, SUPPORT MANUFACTURE AND INSTALLATION, HEAT TRACE INSTALLATION, CONSTRUCTION OF BUILDING AT MID-POINT, NEW PUMP CASING, WIRING, STARTER, ETC, AND FREIGHT WOULD BE EXTRA. WE WOULD ALSO NEED SOME SITE WORK AND ROAD CONSTRUCTION.

PREFERENCES

STAINLESS STEEL PIPE WITH BOLTED FLANGES
REASON LONGEVITY, STRENGTH, CHEMICAL RESISTANCE

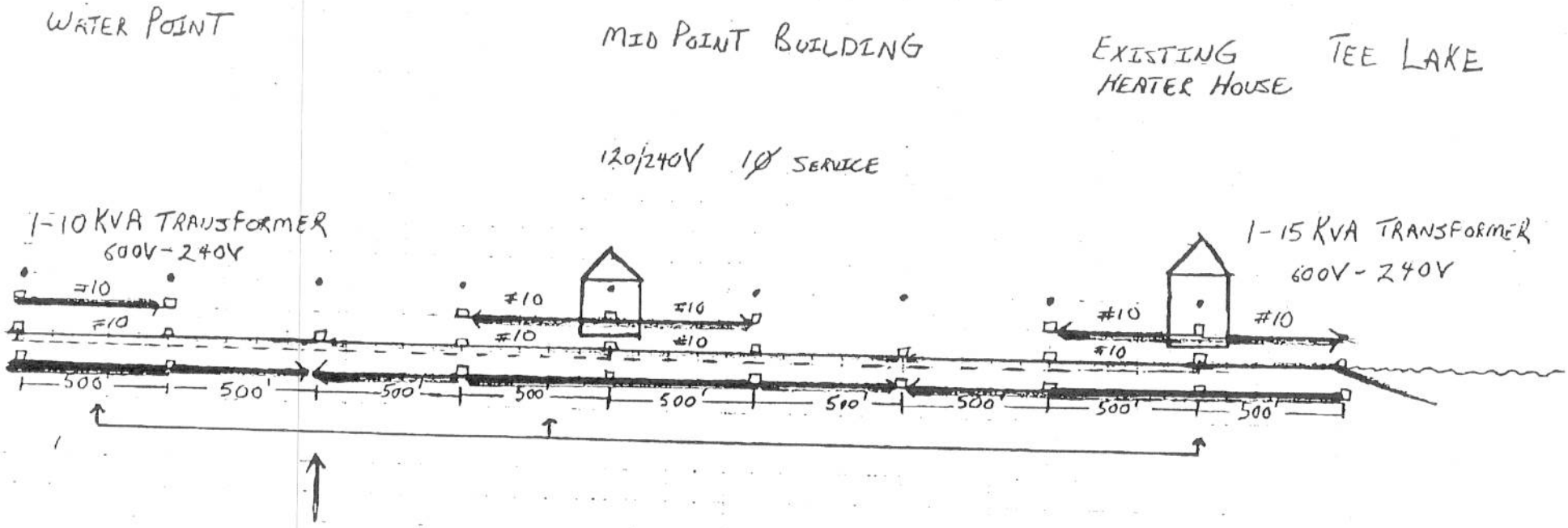
2" URETHANE INSULATION WITH REMOVEABLE METAL CLADDING
REASON EASY TO REPAIR, HEAT TRACE AND PIPE MAINTENANCE SIMPLIFIED

EXTERNAL HEAT TRACE WITH CONTROLS
REASON EASY TO REPAIR BOTH TRACE AND PIPE, CONTROLS WITH ALARMS AND PROGRAMMABLE FEATURES I.E. STAGGER START, POWER LIMITING, GROUND FAULT ALARM AND PROTECTION, ON/OFF TEMP. CONTROL, LOW TEMP. ALARM, HIGH TEMP. ALARM, ETC...

LARGER PUMP
REASON FUTURE CONSUMPTION

HEAT TRACE AND POWER SUPPLY

PIPELINE
HEAT TRACE
3/4" CONDUIT
18 AWG TECK OR BELDEN CABLE FOR CONTROLS AND COMMUNICATIONS



Appendix C
Material Quotes

MEMO

DILLON CONSULTING

TO: Scott Smith 1780-985-2466

c.c.:

FROM: Gary Strong

SUBJECT: **Cape Dorset Water Supply Line Upgrade**

DATE: July 7, 2000

FILE NO.: 00-7879-1000

Per discussion can you provide me budget quotes for the following material supplies. Include the cost of pipe, insulation, outer wrap and joint kits. Please provide cost FOB Cape Dorset.

Lengths are;

140 metres of 65 mm
1100 metres of 75 mm

Option 1

Copper Pipe, screwed fittings - not posible

Option 2

Copper pipe flanged fittings

Option 3

HDPE fused fittings

Option 4

Stainless steel screwed fittings

We'll be putting the heat trace inside the pipe in all the above options, but can you tell me the premium to have one 25 mm cooper tube next to the pipe within the insulation. We will obtain a separate quote for the junction boxes and "Y" fittings for the internal heat trace.

Thank you in advance
Gary Strong, P. Eng.
Project Manager
R:\PROJECTS\DRAFT\007879\Task 1000\Text\Letters\Urecon July 7, 2000.wpd

RECON LTD.
1600 BEDARD AVENUE
ST-LAZARE-DE-VAUDREUIL
QUÉBEC, CANADA J7T 2G4
TEL.: (450) 455-0961 • FAX: (450) 455-0350
E-mail: urecon@urecon.com
Web Site: www.urecon.com

Date:	*July 11, 2000*	**Quote #**	*5321*
From:	*Edmond Cholette*	**Pages:**	*3 (including this page)*
Email:	*e.cholette@urecon.com*	**Email:**	
To:	*Dillon Consulting*	**Tel:**	*867-920-4555*
Att:	*Gary Strong*	**Fax:**	*867-873-3328*
Ref:	*Cape Dorset Water Supply Line Upgrade*	**Closing Date:**	*Budget Prices*

Further to your request we are pleased to quote the following:

Item	Quantity	Description	Unit Price
		OPTION #1	
		*50 mm thick UIP® urethane insulation c/w 1,90 mm thick black polyethylene outer jacket and one (1) joint insulation kit per 20 foot length of the following **Urecon supplied** pipes.*	
01	140 meters	65mm Type K-hard copper pipe	$69.72/m.
02	1100 meters	75mm Type K-hard copper pipe	$89.21/m.
		OPTION #2	
		*50 mm thick UIP® urethane insulation c/w 1,90 mm thick black polyethylene outer jacket of the following **Urecon supplied** pipes.*	
03	140 meters	65mm Type K-hard copper pipe	$64.31/m.
04	1100 meters	75mm Type K-hard copper pipe	$83.50/m.
		*50 mm thick polymer coated insulation kits supplied with accessories to be field installed by others on the following **Urecon supplied** fittings*	
05	As Required	65mm welded copper flanges (prices include 2 flanges and one insulation kits, no nuts and bolts are included)	$487.60/ea.
06	As Required	75mm welded copper flanges (prices include 2 flanges and one insulation kits, no nuts and bolts are included)	$373.37/ea.
		OPTION #3	
		*50 mm thick UIP® urethane insulation c/w 1,90 mm thick black polyethylene outer jacket and one (1) joint insulation kit per 40 foot length of the following **Urecon supplied** pipes.*	
07	140 meters	50mm HDPE DR-11 pipe (65mm not available)	$35.27/m.
08	1100 meters	75mm HDPE DR-11 pipe	$44.88/m.

OPTION #4

		*50 mm thick UIP® urethane insulation c/w 1,90 mm thick black polyethylene outer jacket and one (1) joint insulation kit per 21 foot length of the following **Urecon supplied** pipes.*	
09	*140 meters*	*65mm Type 316 stainless steel pipe (welded joints)*	*$106.70/m.*
10	*1100 meters*	*75mm Type 316 stainless steel pipe (welded joints)*	*$135.11/m.*
11	*1300 meters*	*To supply and install a 25mm copper pipe for heat trace cable on the above pipes.*	*$13.40/m.*
12	*8 only*	*Open crates for maritime shipping (pipes)*	*$250.00/ea.*
13	*4 only*	*Closed crates for maritime shipping (fittings)*	*$250.00/ea.*
14	*1 only*	*Freight to Montreal Docks per truck load*	*$350.00/ea.*

Notes & Conditions

Terms: *All prices are net 30 days.*
Taxes: *All taxes are extra if applicable.*
Freight: *EX works, St Lazare, Qc .*
Returns: *No returns of merchandise can be accepted.*
Validity: *Prices are valid for 30 days and upon receipt of entire order.*
Delivery: *3-4 weeks after receipt of pipe. To be reconfirmed at time of order.*
Dimensions: *All dimensions are nominal, outside diameters may vary.*
Attachments: *Urecon's Warranty.*
Quality: *Urecon is certified to ISO 9001:1994.*

Thank you once again for this opportunity to quote. We look forward to working with you on this project.

Regards,

Edmond Cholette

DATE: July 11, 2000_____

JOB REFERENCE: DILLON CONSULTING

NAME OF CLIENT: CAPE DORSET WATER SUPPLY LINE UPGRADE

CLIENT'S PURCHASE ORDER No.:_____

WARRANTY

Urecon Ltd. warrants it's "U.I.P."® insulation, outer jacket, heat tracing cable and associated accessories to be free of defects in material and workmanship, provided the product is properly handled and installed, for a period of one (1) year from the date of shipment from our plant. Urecon Ltd. shall repair or replace at it's election any portion thereof if it fails to meet the foregoing warranty, provided that installation and application of the product have been properly accomplished and that Urecon Ltd. has been notified of the defect within five (5) days of discovery. The express warranty set forth is exclusive and no other warranties of any kind, whether statutory, oral, written, expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose shall apply.

LIMITATION OF RESPONSIBILITY

Urecon Ltd.'s responsibility is limited to the price of the defective merchandise and Urecon Ltd. shall not be responsible for any consequential or other damages, loss of profits or revenue or loss of use.

URECON LTD.

EDMOND CHOLETTE_____

DILLON CONSULTING

_____

(warranty-responsability.doc)

THERMON®
The Heat Tracing Specialists

THERMON HEAT TRACING SERVICES
10436 – 14 Avenue
Edmonton, AB T6J 5S9
Tel: (780) 437-6326
Fax: (780) 437-0372
E-mail: thermon@telusplanet.net

FAX QUOTATION FORM

To:	Gary Strong	**From:**	Brian McLennan
Company:	M.M. Dillon	**Date:**	July 10, 2000
Phone:	867-920-4555	**Re:**	Internal Heat Trace
Fax:	867-873-3328		Cape Dorset
CC:			

7 page(s), including this cover sheet

☐ Urgent ☑ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

With reference to our conversation today, the recommendations in this quotation are based on the following information:

Design Criteria

- Freeze protection
- Ambient temperature – minus 50°C
- Pipe length – 1240 meters
- Pipe size – 3" diameter, above ground
- Pipe insulation – 2" polyurethane
- Heat trace – 'on' – one or two hours prior to product entry and 'off' one or two hours after drainage of pipe
- Heater cable – internal of pipe c/w reverse gland and pulling eye
- Heat loss – 11.8 w/mt. (3.6 w/ft.)

NOTE: Internal heating is more efficient than external. Normally a maximum of 20 w/mt (6.0 w/ft.) is used as an output.

Internal Trace – M.I. (dual conductor, Form D)

Only M.I. heater cable is C.S.A. approved for this application. Please refer to pages 3, 4, 5 and 6 for details.

Due to the nature of the rigid stainless steel jacket and O.D. sizes, the maximum lengths of cable are recommended.

600 volt source – 70 meters (18 power points or 9 power points with power in the middle)
208 volt source – 30 meters (42 power points or 21 power points with power in the middle)

Control Method

No mechanical or solid state controller (pipe or ambient sensing) is required with the method of on/off prior to and after product entry/exit.

Installation

This is a pull-eye method – through the pipe from one end to another. Therefore, the pipe must be open or have an opening to use a pull tugger.

You cannot push the cable through a long distance.

Bill of Material - 600 volt

18 each M.I. cable sets, 70 meters long c/w a 4' cold lead, reverse gland and pull-eye termination kit

Price $1,986.50/ea. $35,757.00

Loading Data: 600 volts, 1565 watts, 22 w/mt., 70 meters, 3.0 amps

Alternate – External Trace

We can do the whole entire length of the 1240 meters of pipe from one power location using our TEK series resistance heater cable – see page 7

1 each TEK cable set, 1240 meters long c/w fittings Price $25,517.00

Prices are FOB Calgary
Taxes Extra
Delivery – 6 weeks

Regards,

Cape Dorset Heat Loss Calculations upper section

Scenario 1 - Insulation 25 mm lake temp 4

From	Tee Lake		
To	Heater House		
pipe size	62.7 mm		
Insulation	25 mm		
			Value
G=Q*C*R		Q= flow in m/s	0.0060
		C=heat capacity of water	4187000
		R=thermal resistance of insulated pipe	1.80
		R=[ln(ri/rp)]/(2*pi*k)	
		ri=radius of pipe plus insulation	0.05625
		rp=radius of pipe	0.03125
		k=thermal conductivity (foam)	0.052
G=	45,195		
T2=TA+(T1-TA)exp(-l/G)		T2= Temp at Heater House	
		TA= Temp of Air	-50
		T1= Temp of lake water	4
		l=pipe length	140
T2=	3.83		

Scenario 2 - Insulation 50 mm lake temp 4

From	Tee Lake		
To	Heater House		
pipe size	62.7 mm		
Insulation	50 mm		
			Value
G=Q*C*R		Q= flow in m/s	0.0060
		C=heat capacity of water	4187000
		R=thermal resistance of insulated pipe	2.92
		R=[ln(ri/rp)]/(2*pi*k)	
		ri=radius of pipe plus insulation	0.08125
		rp=radius of pipe	0.03125
		k=thermal conductivity (foam)	0.052
G=	73,470		
T2=TA+(T1-TA)exp(-l/G)		T2= Temp at Heater House	
		TA= Temp of Air	-50
		T1= Temp of lake water	4
		l=pipe length	140
T2=	3.90		

Scenario 3 - Insulation 25 mm lake temp 0.5

From	Tee Lake		
To	Heater House		
pipe size	62.7 mm		
Insulation	25 mm		
			Value
G=Q*C*R		Q= flow in m/s	0.0060
		C=heat capacity of water	4187000
		R=thermal resistance of insulated pip	1.80
		R=[ln(ri/rp)]/(2*pi*k)	
		ri=radius of pipe plus insulation	0.05625
		rp=radius of pipe	0.03125
		k=thermal conductivity (foam)	0.052
G=	45,195		
T2=TA+(T1-TA)exp(-l/G)		T2= Temp at Heater House	
		TA= Temp of Air	-50
		T1= Temp of lake water	0.5
		l=pipe length	140
T2=	0.34		

Scenario 4 - Insulation 50 mm lake temp 0.5

From	Tee Lake		
To	Heater House		
pipe size	62.7 mm		
Insulation	50 mm		
			Value
G=Q*C*R		Q= flow in m/s	0.0060
		C=heat capacity of water	4187000
		R=thermal resistance of insulated pipe	2.92
		R=[ln(ri/rp)]/(2*pi*k)	
		ri=radius of pipe plus insulation	0.08125
		rp=radius of pipe	0.03125
		k=thermal conductivity (foam)	0.052
G=	73,470		
T2=TA+(T1-TA)exp(-l/G)		T2= Temp at Heater House	
		TA= Temp of Air	-50
		T1= Temp of lake water	0.5
		l=pipe length	140
T2=	0.40		

Cape Dorset Heat Loss Calculations lower section

Scenario 1 - Insulation 25 mm lake temp 4

From	Heater House		
To	Truckfill Station		
pipe size	77.93 mm		
Insulation	25 mm		
			Value
G=Q*C*R		Q= flow in m/s	0.0060
		C=heat capacity of water	4187000
		R=thermal resistance of insulated pipe	1.52
		R=[ln(ri/rp)]/(2*pi*k)	
		ri=radius of pipe plus insulation	0.0640
		rp=radius of pipe	0.0390
		k=thermal conductivity (foam)	0.052
G=	38,112		
T2=TA+(T1-TA)exp(-l/G)		T2= Temp at Truckfill Station	
		TA= Temp of Air	-50
		T1= Temp at Heater House	3.83
		l=pipe length	1100
T2=	2.30		

Scenario 2 - Insulation 50 mm lake temp 4

From	Heater House		
To	Truckfill Station		
pipe size	77.93 mm		
Insulation	50 mm		
			Value
G=Q*C*R		Q= flow in m/s	0.0060
		C=heat capacity of water	4187000
		R=thermal resistance of insulated pipe	2.53
		R=[ln(ri/rp)]/(2*pi*k)	
		ri=radius of pipe plus insulation	0.088965
		rp=radius of pipe	0.0390
		k=thermal conductivity (foam)	0.052
G=	63,479		
T2=TA+(T1-TA)exp(-l/G)		T2= Temp at Truckfill Station	
		TA= Temp of Air	-50
		T1= Temp at Heater House	3.897198
		l=pipe length	1100
T2=	2.97		

Scenario 3 - Insulation 25 mm lake temp 0.5

From	Heater House		
To	Truckfill Station		
pipe size	77.93 mm		
Insulation	25 mm		
			Value
G=Q*C*R		Q= flow in m/s	0.0060
		C=heat capacity of water	4187000
		R=thermal resistance of insulated pipe	1.52
		R=[ln(ri/rp)]/(2*pi*k)	
		ri=radius of pipe plus insulation	0.063965
		rp=radius of pipe	0.0390
		k=thermal conductivity (foam)	0.052
G=	38,112		
T2=TA+(T1-TA)exp(-l/G)		T2= Temp at Truckfill Station	
		TA= Temp of Air	-50
		T1= Temp at Heater House	0.343809
		l=pipe length	1100
T2=	-1.09		

Scenario 4 - Insulation 50 mm lake temp 0.5

From	Heater House		
To	Truckfill Station		
pipe size	77.93 mm		
Insulation	50 mm		
			Value
G=Q*C*R		Q= flow in m/s	0.0060
		C=heat capacity of water	4187000
		R=thermal resistance of insulated pipe	2.53
		R=[ln(ri/rp)]/(2*pi*k)	
		ri=radius of pipe plus insulation	0.088965
		rp=radius of pipe	0.0390
		k=thermal conductivity (foam)	0.052
G=	63,479		
T2=TA+(T1-TA)exp(-l/G)		T2= Temp at Truckfill Station	
		TA= Temp of Air	-50
		T1= Temp at Heater House	0.403861
		l=pipe length	1100
T2=	-0.46		

MIQ™
Mineral Insulated Cable

Product Specifications

Application . . .

Process Temperature Maintenance or Freeze Protection
MIQ high performance mineral insulated heating cables are used extensively for high temperature maintenance, high temperature exposure and/or high watt density applications which exceed the limitations of thermoplastic insulated cables. The resistance configurations available can provide tracing for pipes up to 1 mile (1.6 km) long from a single power supply point.

Thermon's MIQ mineral insulated cables are manufactured using Alloy 825, a high nickel/chromium alloy ideally suited for high temperature service that offers exceptional resistance to stress corrosion in chloride, acid, salt and alkaline environments.

MIQ cables are approved for use in ordinary (nonclassified) areas, hazardous (classified) areas, and Zone 1 and 2 classified areas.

Ratings . . .

Rated voltage[1]	300 and 600 Vac
Max. maintenance temperature[2]	932°F (500°C)
Max. continuous exposure temperature	
Power-off	1,100°F (593°C)
Max. watt density[2]	up to 80 w/ft (262 w/m)
Minimum bend radius	6 x cable O.D.

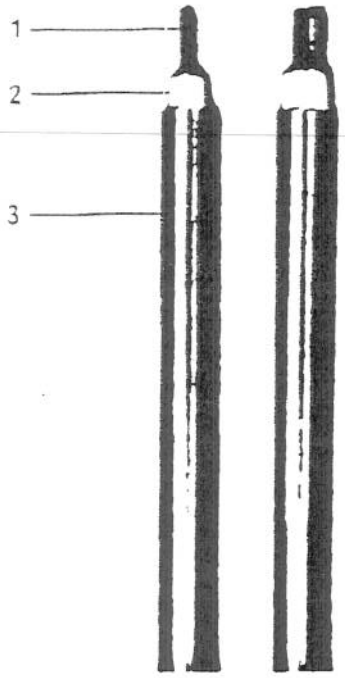
MIQ Heater Sets . . .

Thermon MIQ cable sets are available in four factory fabricated configurations: Types A, B, D or E. The standard assemblies consist of a predetermined length of heating cable joined to a standard[3] 4' (1,220 mm) nonheating "cold lead" with 12" (305 mm) long thermoplastic insulated pigtails.

The nonheating section of the unit is sealed and fitted with a high pressure, liquid-tight 1/2" or 3/4" NPT stainless steel gland[4] for connection into the supply junction box.

Notes . . .

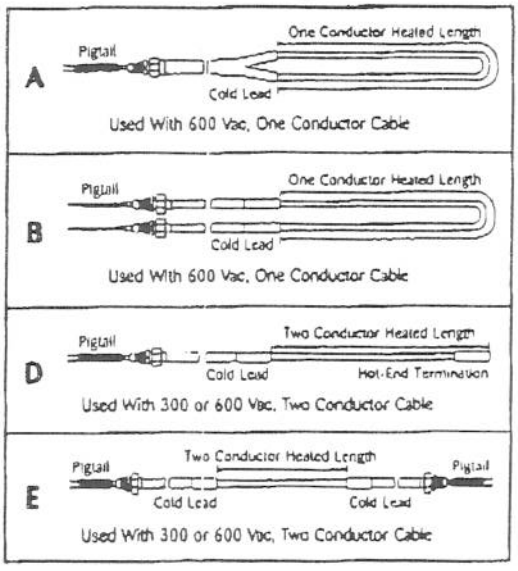
1. Definition as stated in IEEE Standard 515-1997. Specific voltage depends on circuit length and design conditions.
2. Watt density limitations are correlated to maintain temperatures.
3. Standard cold lead sheath is Alloy 825. If copper sheath is required, contact Thermon. Cold lead will be sized for the circuit operating current in accordance with relevant NEC or CEC code requirements.
4. Cold lead gland is ½" NPT except for 2-conductor 10 AWG and larger for which a ¾" NPT gland is provided.



Construction . . .

1 Solid Alloy or Copper Conductor(s)
2 Compacted Magnesium Oxide Insulation
3 Alloy 825 Sheath

Heater Set Types



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www.thermon.com In Canada call **1-800-563-8461**

ISO 9001 REGISTERED

MIQ ™

Mineral Insulated Cable

MI HEATRACE ©
CABLE SELECTION

A heater cable selection can be made by following these steps:

A.

[LINEAL HEAT LOSS] x [TRACING SYSTEM LENGTH] = TOTAL WATTS REQUIRED

B.

[SYSTEM AC VOLTS]^2 ÷ [TOTAL WATTS REQUIRED] = ACTUAL TOTAL OHMS REQUIRED

C.

[TOTAL OHMS REQUIRED] ÷ [REQUIRED MI CABLE LENGTH] = REQUIRED OHMS/M OR OHMS/FT

Refer to Chart and select the MI Heatrace Cable having a resistance equal to or slightly lower than calculated in step C. Proceed with the following calculations to establish actual operating data:

D.

[TOTAL CABLE LENGTH] X [ACTUAL MI CABLE RESISTANCE] = OHMS TOTAL

E.

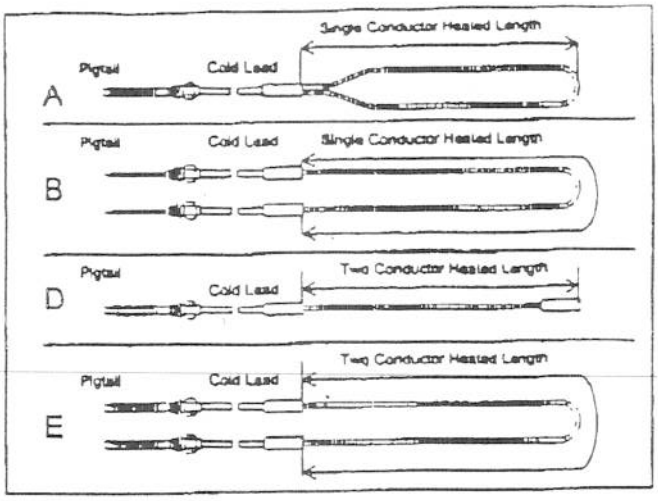
[AC VOLTS]^2 ÷ [OHMS TOTAL] = WATTS TOTAL

F.

[WATTS TOTAL] ÷ [AC VOLTS] = AMPS TOTAL

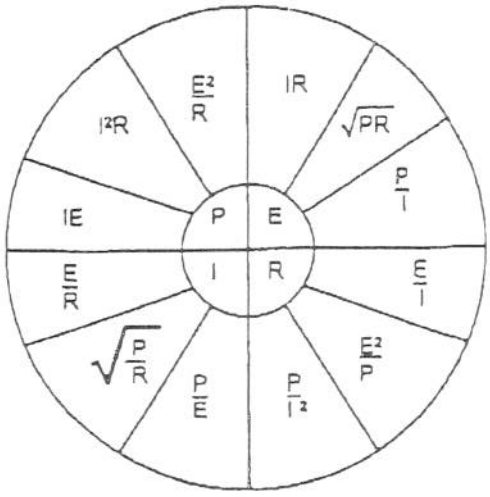
G.

[WATTS TOTAL] ÷ [MI HEATING CABLE LENGTH] = WATTS/M OR WATTS/FT



HEATING CABLE IDENTIFICATION CHART

600 V RATED CABLE				300 V RATED CABLE	
One (1) Conductor	Ohms/ft @20° C	Two (2) Conductor	Ohms/ft @20° C	Two (2) Conductor	Ohms/ft @20° C
MIQ-20E1H-1S	2.00	MIQ-11E0H-2S	11.00	MIQ-11E0L-2S	11.00
MIQ-16E1H-1S	1.80	MIQ-90E1H-2S	9.00	MIQ-90E1L-2S	9.00
MIQ-13E1H-1S	1.30	MIQ-80E1H-2S	6.00	MIQ-75E1L-2S	7.50
MIQ-10E1H-1S	1.00	MIQ-40E1H-2S	4.00	MIQ-60E1H-2S	6.00
MIQ-85E2H-1S	0.85	MIQ-20E1H-2S	2.00	MIQ-50E1L-2S	5.00
MIQ-70E2H-1S	0.70	MIQ-10E1H-2S	1.00	MIQ-40E1L-2S	4.00
MIQ-50E2H-1S	0.50	MIQ-70E2H-1S	0.70	MIQ-32E1L-2S	3.20
MIQ-38E2H-1S	0.38	MIQ-50E2H-2S	0.50	MIQ-27E1L-2S	2.70
MIQ-30E2H-1S	0.30	MIQ-30E2H-1S	0.30	MIQ-25E1L-2S	2.50
MIQ-25E2H-1S	0.25	MIQ-20E2H-2S	0.20	MIQ-20E1L-2S	2.00
MIQ-20E2H-1S	0.25	MIQ-15E2H-2S	0.15	MIQ-17E1L-2S	1.70
MIQ-17E2H-1S	0.17	MIQ-10E2H-2S	0.10	MIQ-14E1L-2S	1.40
MIQ-15E2H-1S	0.15	MIQ-70E3H-2S	0.07	MIQ-10E1L-2S	1.00
MIQ-10E2H-1S	0.10	MIQ-50E3H-2S	0.05	MIQ-70E2L-2S	0.70
MIQ-80E3H-1S	0.08	MIQ-40E3H-2S	0.04	MIQ-50E2L-2S	0.50
MIQ-70E3H-1S	0.07	MIQ-30E3H-2S	0.03	MIQ-30E2L-2S	0.30
MIQ-60E3H-1S	0.06			MIQ-25E2L-2S	0.25
MIQ-40E3H-1S	0.04			MIQ-20E2L-2S	0.20
MIQ-30E3H-1S	0.03			MIQ-15E2L-2S	0.15
MIQ-20E3H-1S	0.02			MIQ-10E2L-2S	0.10
				MIQ-70E3L-2S	0.07
				MIQ-50E3L-2S	0.05



THE POWER CIRCLE

MIQ.doc

MI CABLE FIELD TESTING PROCEDURES

A. Check MI cable with 500 volt insulation tester.

1. When received: minimum reading 20 megohms. If below minimum, contact factory.
2. Before installation of cable: minimum reading 20 megohms. If below minimum, contact supervisor.
3. After installation of cable: minimum reading 5 megohms. If below minimum, contact supervisor.
4. After thermal insulation is applied: minimum reading 5 megohms. If below minimum, contact supervisor.

B. Supervisor's instructions for megger readings below acceptable minimum.

1. When received: contact factory with megger readings below acceptable minimum at this point.
2. Before installation: a megger reading below acceptable minimum at this point should start the following investigation.

    a. Visually inspect the cable for physical damage.
    b. Check storage area: the cables should be stored in a relatively dry location out of the elements. Make sure that the power ends are covered while stored.
    c. Check resistance from conductor to sheath with an ohm meter. If reading is over 2000 ohms, the problem is likely to be moisture. Moisture can be overcome by heat with a torch, a heat gun, or by applying a lower voltage and letting the cable heat for a few hours. If the ohm reading is under 2000 ohms, the cable should be repaired or replaced.

3. After installation: a low megger reading at this point should be referred to steps 2a and 2c above.
4. After insulation: a low megger reading at this point should be referred to steps 2a and 2c above. With the insulation installed, the only available point to heat with a heat source is the cold lead. Try to expose the hot to cold junction. This is the likely location for the moisture to get in or out due to the physical welding or soldering in this area. If the design voltage is all that is available to energize the cable, check with the factory or the project manager before energizing.

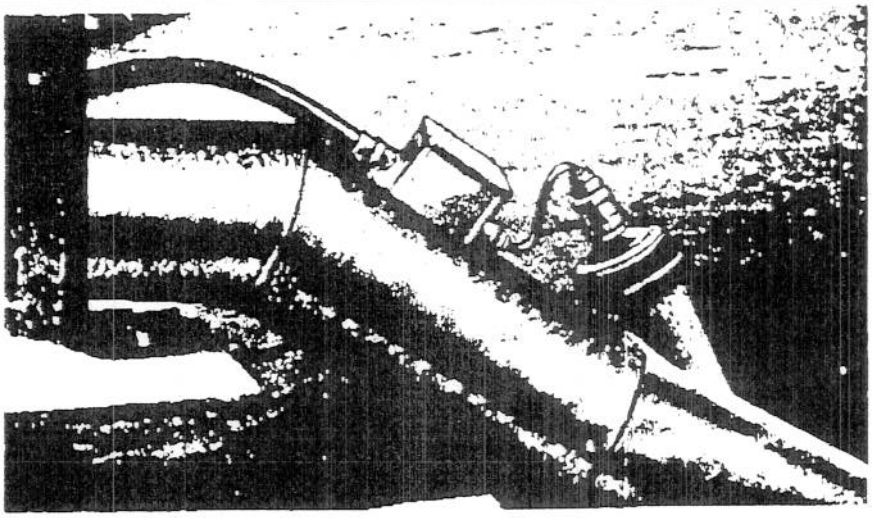
Metal Pipes (Internal)

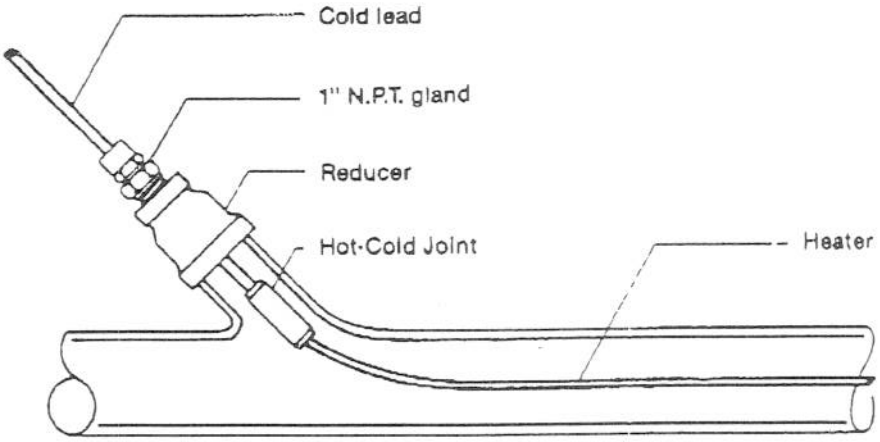
Where possible pipes should be traced externally to permit cleaning of the line without removing the heater; also pulsating conditions could cause fatigue failures. However, for buried, existing lines, internal tracing will save expensive excavation.

DESIGN REQUIREMENTS

Heat losses are calculated as for external tracing but no excess cable is provided for — the heater length must match the pipe length as the heater must be drawn into the pipe and excess cable cannot be lost. Valves must be traced externally. One-inch gland connectors are required to effect a liquid tight seal where the cold lead emerges from the pipe. Unless designed, the heater should be ordered with a temporary seal at one end so that the unit can pass through the flange entry. Do not exceed watts per foot of cable given in Tables L and M, pages 18 and 19.

This system should be thermostatically controlled.





TYPICAL INSTALLATION Internal traced section of pipe

TEK™
Series Constant Watt Heating Cable

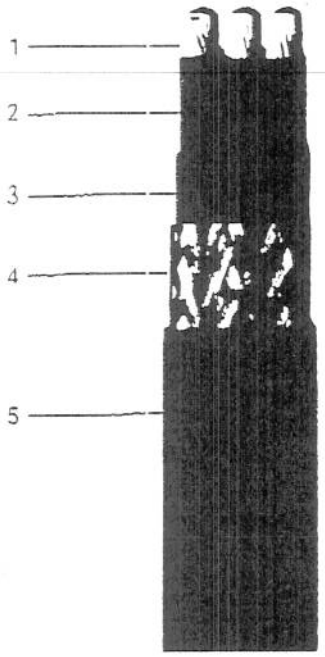
Product Specifications

Application . . .

Long Line Temperature Maintenance or Freeze Protection
TEK series resistance constant watt heating cables are used where circuit lengths exceed the limitations of parallel resistance heating cables. Circuit lengths up to 12,000 feet (3,658 m) can be energized from a single power supply point.

The series circuitry of TEK provides consistent watt-per-foot power output along the entire length of the cable with no voltage drop.

TEK cables are approved for use in ordinary (nonclassified) and hazardous (classified) areas.



Ratings . . .

Rated voltage[1] ..... for operation up to 575 Vac
Max. maintenance temperature[2] ..... 215°F (101°C)[3]
Max. continuous exposure temperature
Power-off ..... 400°F (204°C)
Minimum installation temperature ..... -60°F (-51°C)
Minimum bend radius ..... 1.25" (32 mm)

Basic Accessories . . .

Power Connection: All TEK cables require a cold lead transition for connection to power (available as a factory termination or a field fabricated kit). Refer to the back of this specification sheet for details.

End-of-Circuit Termination: An end-of-circuit termination must also be used with TEK cables. This termination, detailed on the back of this specification sheet, is available as a factory termination or a field fabricated kit.

Construction . . .

1 Heating Conductors (2 or 3)
2 Fluoropolymer Dielectric Insulation
3 Fluoropolymer Pairing Jacket
4 Nickel-Plated Copper Braid (BN)

Options . . .

5 OJ Fluoropolymer overjacket over nickel-plated copper braid provides additional protection to cable and braid where exposure to chemicals or corrosives is expected.

Notes . . .

1. Definition as stated in IEEE Standard 515-1997. Specific voltage depends on circuit length and design conditions.
2. Watt density limitations are correlated to maintain temperatures.
3. Higher maintenance temperatures may be possible, contact Thermon for design assistance.

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Appendix D
Canadian Copper & Brass Development Association

CANADIAN COPPER & BRASS DEVELOPMENT ASSOCIATION
49 The Donway West, Suite 415, Don Mills, Ontario M3C 3M9
Telephone: (416) 391-5599
Fax: (416) 391-3823

July 11, 2000

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Co./Dept./Div./Service DCL — Yellowknife | Co./Cie PCC — Hfx
Phone # / N° de tél. | Phone # / N° de tél.
Fax # / N° de télécopieur | Fax # / N° de télécopieur
(Refer to my earlier e-mail)

To: Henry Tam
Dillon Consulting Engineers

Fax: 902-454-6886

From: John Catterall - Technical Manager
Canadian Copper & Brass Development Association

Pages: 1

Re: Use of copper tube for an underground water supply line in Yellowknife, NWT

After reviewing the information that you provided to us about this application, we have several comments about using copper tube. The reading of –4 for the Langelier Index of the water typically indicates that a protective calcium carbonate scale will not form on the interior of the copper tube and that the water is more corrosive than one with a positive index.

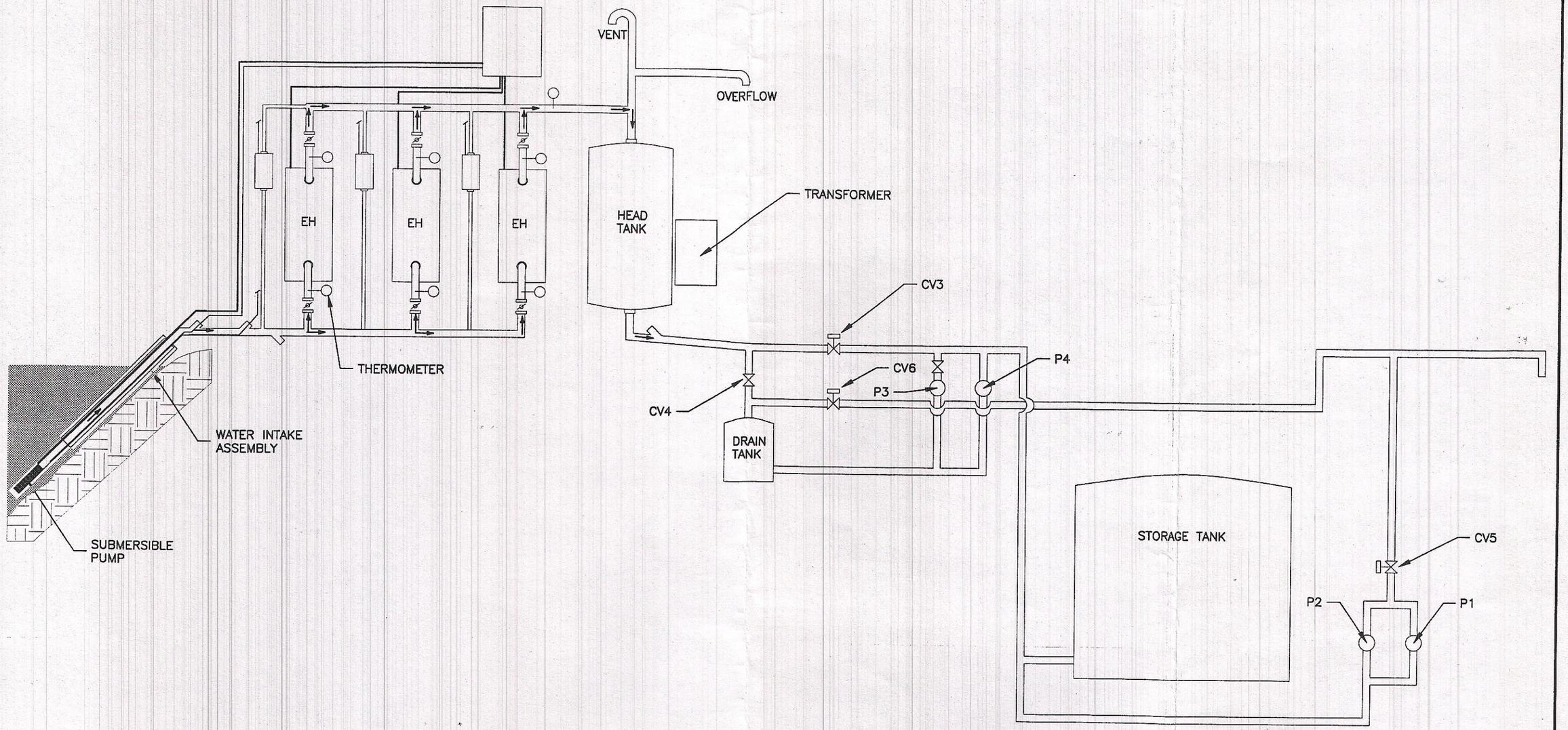
The fact, that the line will only see intermittent use and remain empty for most of the time may affect its service life as well. Although the plumbing inspector in Yellowknife has confirmed that copper underground service lines from the ductile iron mains have been used successfully for a number of years, the water in these cases is constantly circulating through the copper supply and return lines to and from each building.

Based on the water chemistry, intermittent usage of the line and the lack of any similar case histories upon which to form an opinion, we cannot say for certain that copper tube would be preferable to the galvanized steel currently used in this application.

If you wish to discuss this matter further, please do not hesitate to contact us again

Appendix E
Heat Loss Calculations

Appendix F
Figures



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LOG FILE: NA

DILLON CONSULTING

PROJECT: CAPE DORSET WATER SUPPLY

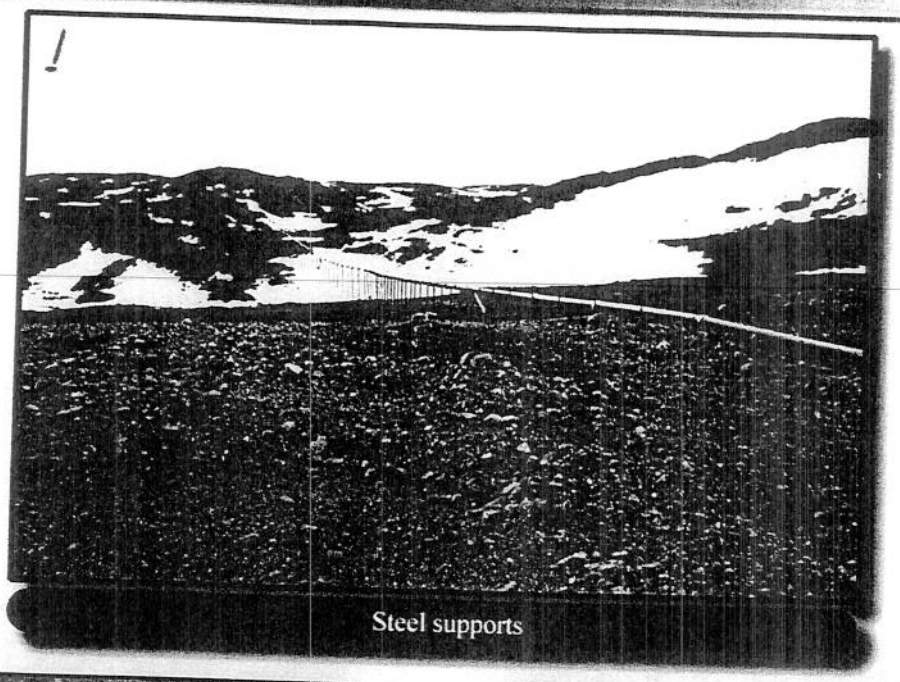
TITLE: WATER SUPPLY SYSTEM FLOW DIAGRAM

PROJECT NUMBER: 00-7879

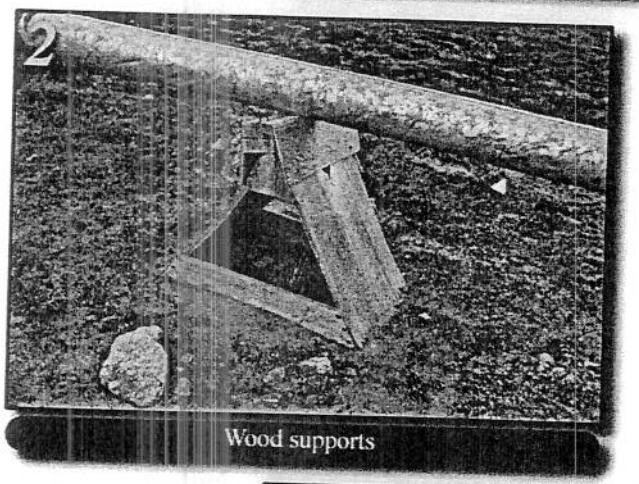
DATE: JULY 00

FIGURE NUMBER: FIG 1

Photo Plate 1

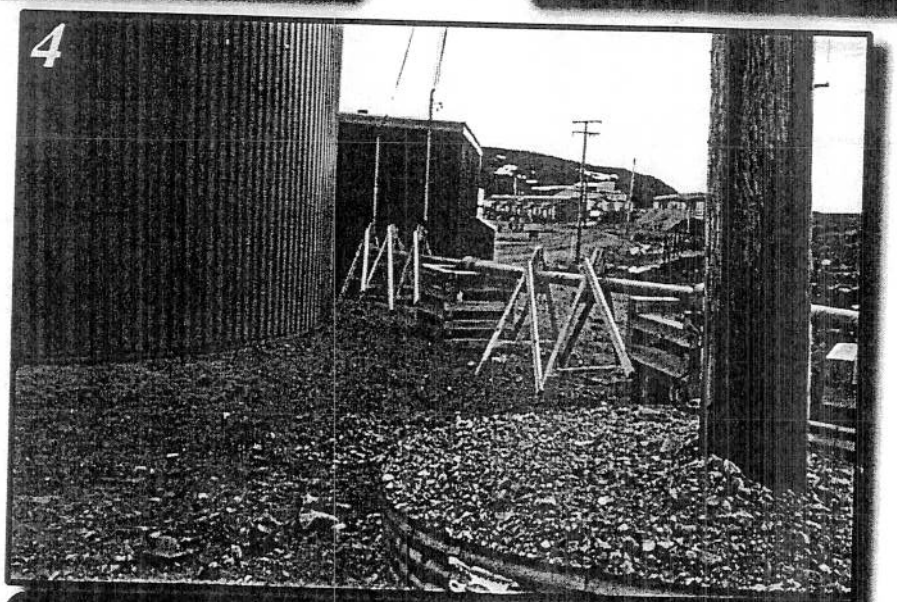


Steel supports



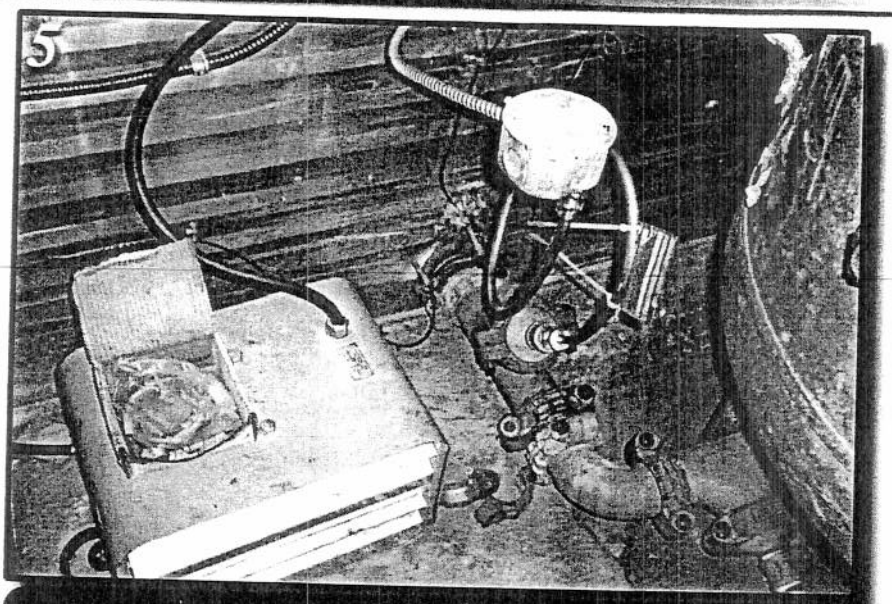
Wood supports

Shimming of steel supports

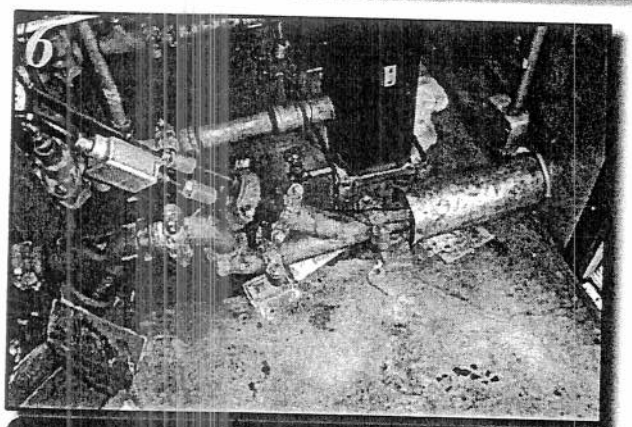


Wood supports at Truckfill station

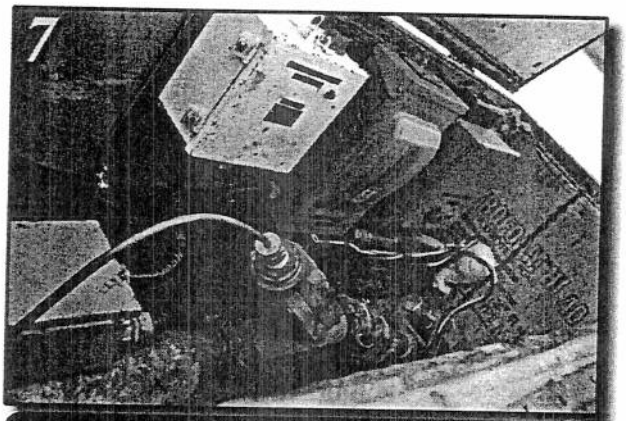
Photo Plate 2



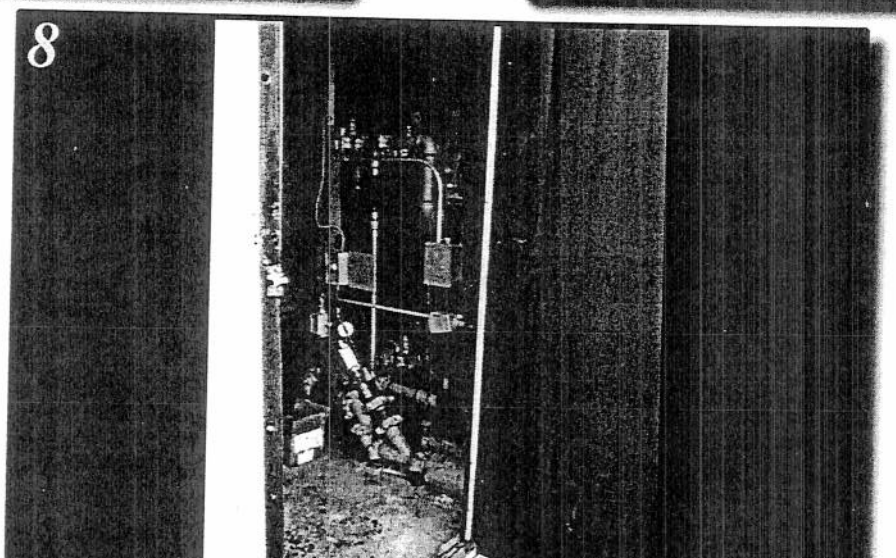
Piping to TFS



Piping to Intake



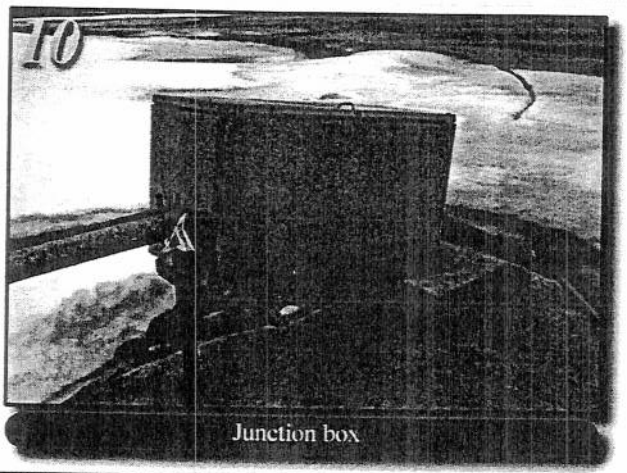
Heat trace in section



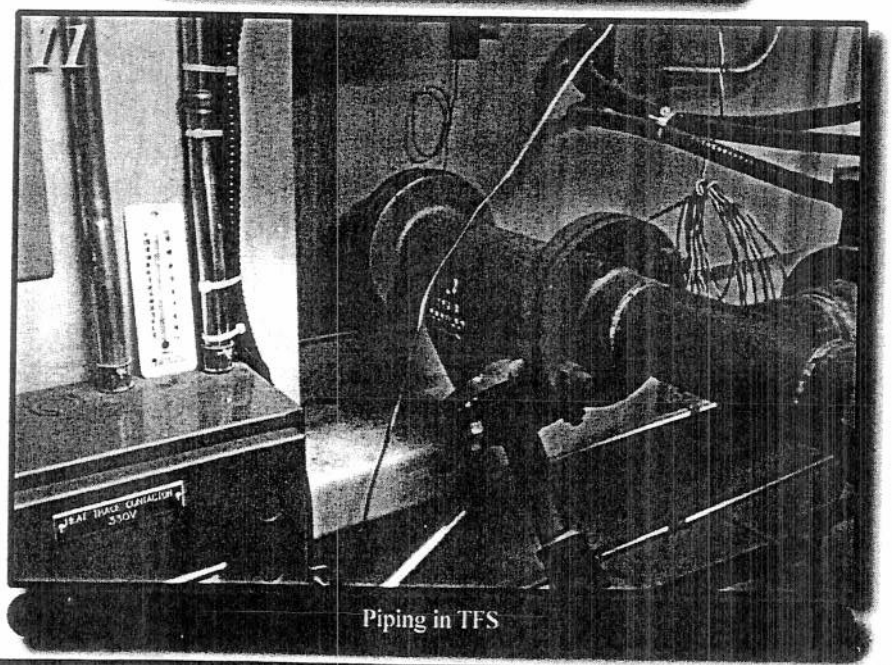
Door

Photo Plate 3

Intake & junction box



Junction box



Piping in TFS

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Appendix B - Hamlet's Submission
Appendix C - Material Quotes
Appendix D - Canadian Copper & Brass Development Association
Appendix E - Heat Loss Calculations
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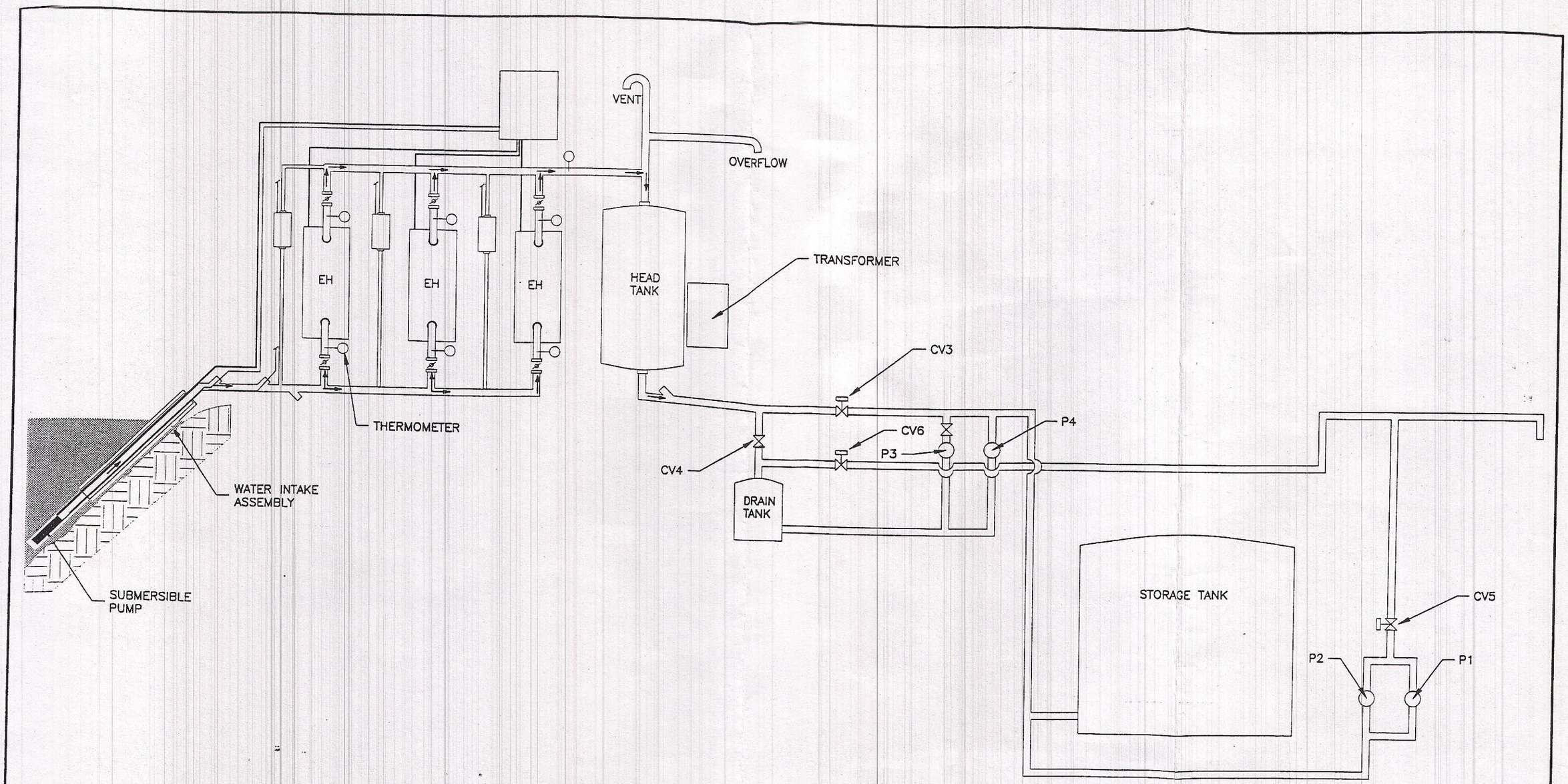

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DILLON CONSULTING

PROJECT
CAPE DORSET
WATER SUPPLY

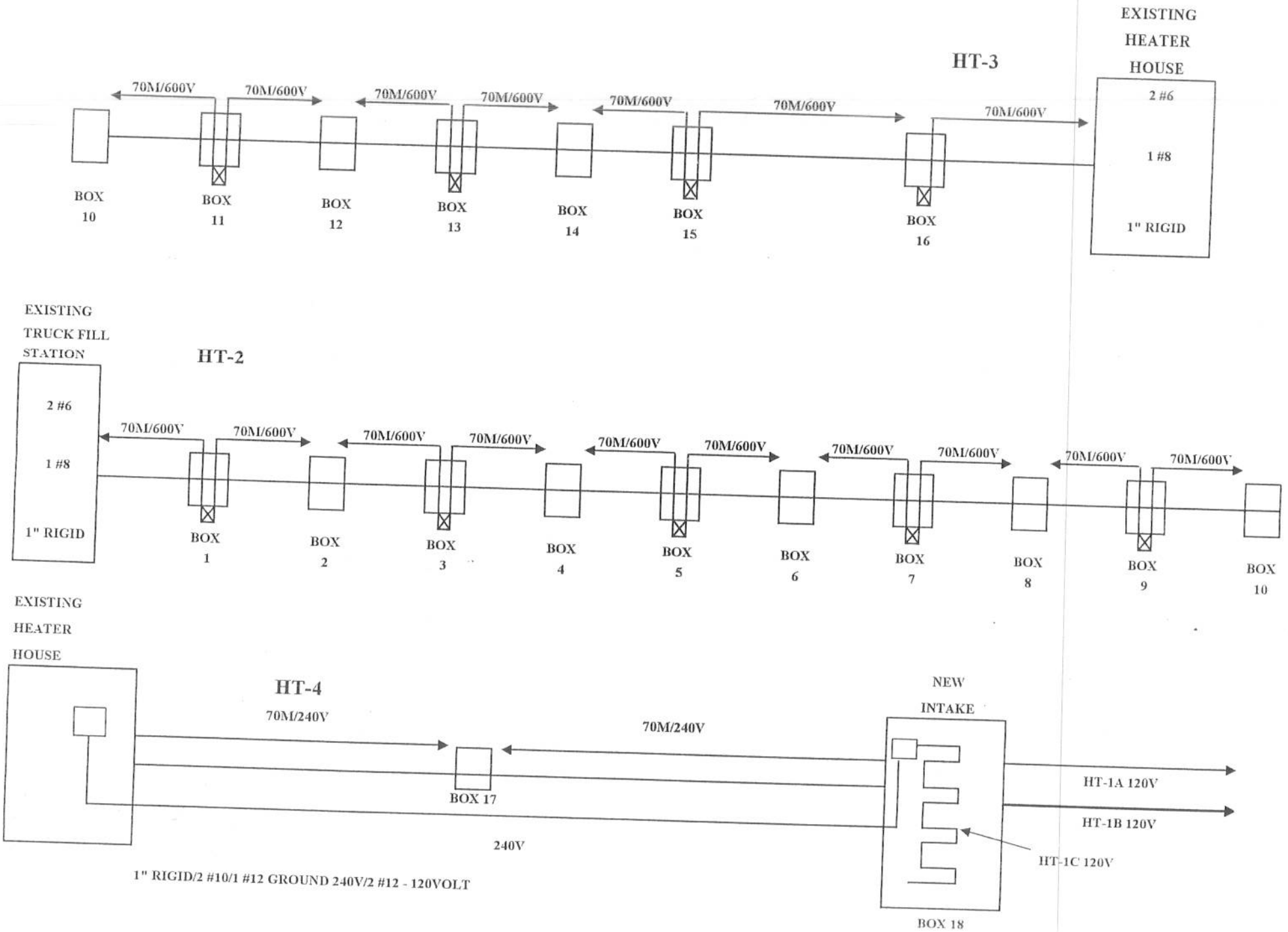
TITLE
WATER SUPPLY SYSTEM
FLOW DIAGRAM

PROJECT NUMBER
00-7879

DATE
JULY 00

FIGURE NUMBER
FIG 1

CAPE DORSET HEAT TRACE ON NEW WATER PIPELINE



5.0 COMPONENT DATA

5.1 General

Chapter 5 contains information on equipment used, including the manufacturer, model, and size. Cross references to the manufacturers' data in Chapter 9, and functional data in Chapter 4 are included. The suppliers' names, addresses, and telephone numbers are also listed on this table.

WATER SUPPLY IMPROVEMENTS
CAPE DORSET, NUNAVUT

COMPONENTS, MANUFACTURERS AND SUPPLIERS

Description	Manufacturer and Model	Supplier
Non-Reversing Insta Kit – Magnetic Starter	Telemecanique	
3 Position selector switch	Telemecanique	
Control Circuit Transformer	Telemecanique	
Control Circuit – auxiliary contact block	Telemecanique	
Heavy Duty Safety Switch 3-Pole, not fusible, Type 1	Square D – Schneider Electric CHU361 DE2	Schneider Electric
CDP Panelboard	Federal Pioneer CDP Panelboard	Schneider Electric

6.0 OPERATING PROCEDURES

6.1 General

The water supply pipeline system for Cape Dorset, Nunavut consists of:

.1 An intake system consisting of 2 intake lines each with their own pump and screen. The intakes are located inside a 300 m insulated casing pipe in Tee Lake. The pumps are connected to a 100 mm off take. The off takes are connected within the junction box where one intake line can be selected by operating the valves. The junction box outlet is 67 mm diameter stainless steel insulated and heat traced water supply line to the heater house.

.2 The submersible pumps are connected to a 100 mm HDPE intake pipe is situated inside the 300 pipe casing.

.3 The heater house provides for water tempering. The outlet to the heater house is a 75 mm gravity flow stainless steel insulated and heat traced pipeline to the water storage tank located at the truckfill station.

For a full description of the heater house and the trukfill station operation, see the O&M Manual for those facilities. This manual covers only the pipeline operation.

6.2 Normal Operating Procedures

The normal operating procedures for the water supply pipeline system includes:

- The storage tank level sensor initiates the filling cycle
- The sensor calls on the intake pumps. The selected pump will be energized.
- Water will flow from the intake to the heater house. The immersion heaters will be activated and energized.
- The water is tempered in the heater house and flows by gravity to the water storage tank.
- The level sensor will de-energize the intake pump once the level of the tank has reached the high level sensor limit.
- The line will drain by gravity until the level of the water in the supply pipeline is at the

liquid level of the Water Storage Tank.

- MV3 will be closed
- MV 4 will be opened
- Water will drain into the Drain Tank from the supply pipeline.
- Pump 3 (or 4) will be activated by the level switch in the Drain Tank and these will pump the water into the Water Storage Tank.
- Once the drain tank and the pipeline are empty, MV 4 will close and MV 3 will open.
- Heat trace for the pipeline will be turned on and off throughout the operation by the temperature sensors on the supply line.

6.3. Intake Screen Back-washing

The intake screen has been sized such that cleaning should not be required. In the unlikely event that the screen is becoming clogged, the intake screen may be backwashed by recirculating water from the existing intake line through the casing. This procedure may help to remove some silt or material that otherwise plugs the screen. However, it is not a completely effective cleaning because the intake pump recirculates more than it will backwash. The only practical methods to completely clean the screen is to clean the screen when the reservoir is empty, have divers unclog and clean the screen by hand, or by applying high pressure air from the inside of the screen.

6.4 Heat Trace System

There is a heat trace system installed inside the pipeline. The electric heat trace will prevent freezing and aid in thawing of the pipe should it ever become frozen.

The heat trace cables are operated by a two temperature monitor and controllers systems. The lower heat trace controller is located in the Truckfill station, the upper heat trace controller is located in the heater house. Both systems report back to the alarm panel located in the truckfill station.

Use of the heat trace during summer is not required. The controller will be enabled, but the heat trace cables will not be activated during warmer weather due to the thermostat not activating the cables.

The heat trace controller has been set to perform optimally. However, the operator experience may indicate alternative settings provide better protection, or better operational cost benefits.

6.4 SPECIAL PROCEDURES

6.4.1 Intake Pump Removal

If the intake pump, or other equipment within the intake casing, fails, the intake pipe and all attached equipment can be removed from inside the Junction box. DO NOT attempt to remove the pump unless an electrician is present to disconnect the power cables.

Care must be taken when using a vehicle (ATV or snow machine) to assist removal to ensure that the cable is not snapped which could cause injury, and make the remaining pump removal extremely difficult.

Water from the pipeline will not be available during the pump removal and replacement.

Location: All of the following procedure can be completed from the junction box at the intakes and in the Heater House.

.1 **Location**: At the breaker panel in the heater house
Turn off the breakers for the pumps and the heat trace controllers.

.2 **Location**: At the intake casing.
Turn the truckfill pump starter to the OFF position.

.3 Disconnect the pump power cable from the starter. This MUST be done by a

certified electrician.

.4 Unplug the heat trace cables from the receptacle.

.5 Disconnect one of the fittings on the pipe closest to the intake casing.

.6 Move the pipe out of the way. More fittings may need to be removed to accommodate the pump removal.

.7 Remove the outer set of bolts on the intake casing flange.

.8 Loosen the inner set of four bolts on the flange which loosens the rubber plug.

.9 Pull the flange and plug out of the casing.

.10 Remove the four bolts from the flange.

.11 Remove the flange and plug.

.12 Pull out the intake pipe, using a quad or snow machine, carefully supporting the pipe and cables. Once the pipe is a meter or so out of the casing it may be easier to connect the cable to a loader to continue pulling.

.16 Carefully support the pipe and cables during pulling. Watch for snags, and any wedging that may occur during removal.

.17 The pipe is approximately 15 metres long.

.18 Once the pipe is pulled, the pump, heat trace RTD sensors, or heat trace cables can be maintained, repaired or replaced.

.19 Reverse the above procedures to replace the pump and pipe.

6.4.2 Heat Trace Checks

On an annual basis, and during the summer months the amperage draw for the pipeline heat trace is to be checked. This is done be energizing the heat trace system by turning the control thermostat until the heat trace is on. The light on the control panel inside the Truckfill station door indicates when the heat trace is on. Each Junction box is to be opened, and the amperage draw for each leg of the heat trace measured and recorded. This is to be completed by an electrician. The values recorded are to be verified against the values shown on the record drawings. Heat trace that show a significant drop in amperage draw are to be replaced prior to the winter.

6.5 TROUBLE SHOOTING PROCEDURES

Alarms

.1 Low Building Temperature

This alarm is transmitted from the low temperature alarm thermostat to the Honey well panel. It indicates that the building temperature is lower than the set point (initially set at 10 °C) and may indicate a heater failure. THIS ALARM MUST BE DEALT WITH PROMPTLY TO ENSURE THAT THE FACILITY AND INTERNAL EQUIPMENT DOES NOT FREEZE. See O&M Manual for the truack fill station for appropriate response.

.2 Heat Trace Alarm

An alarm will be activated when the heat trace controller sends an alarm signal to the control panel. This indicates that the heat trace breaker has failed and the heat trace is no longer active.

The heat trace alarm on the control panel can be cleared by taking the following actions:

- Acknowledge the alarm.
- Determine the cause of the alarm. Reset breakers and check fuses.

7.0 MAINTENANCE PROCEDURES

7.1 General

Maintenance on the Guard-It autodialer is the battery. Batteries need to be replaced every three years since it will eventually fail with old age in the same way that an automobile battery does.

Replacements for this battery must be ordered near the time of change out since long storage on a shelf without a charger will damage the battery. It may be ordered from Raco or from the manufacturer as printed on the battery.

The amperage draw of each heat trace cable is to be checked under normal operating conditions once per year. It is recommended that this be completed in the summer months. The measured amperage draw should be compared to the data provided on the record drawings. Deviations to the data indicates that the heat trace length is to be replaced.

8.0 TESTING AND CERTIFICATION DATA

8.1 General

Pipe testing data and contractors certification follows.

Each heat trace length amperage draw was recorded at the time of commissioning. These values are shown on the record drawings.

KRT
ELECTRICAL

P.O. Box 1259
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Phone: (867) 979 – 2639
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E-mail: krtelect@nunanet.com

WARRANTY ON GN PROJECT 4-002-473

K.R.T. ELECTRICAL LTD. WARRANTIES THE ELECTRICAL INSTALLATION FOR THE WATER SUPPLY PIPELINE REPLACEMENT CAPE DORSET, NUNAVUT FOR A PEROID OF ONE YEAR FROM THE DATE OF INTERM INSPECTION. WE HEREBY UNDERTAKE TO GUARANTEE ALL ATERIALS SUPPLIED AND INSTALLED UNDER OUR CONTRACT AND INCLUDE THE PROVIDING OF NECESSARY MATERIALS AND LABOUR TO COVER THE REPAIR OR REPLACEMENT OF THE ABOVE WORK REQUIRED AS A RESULT OF FAULTY MATERIALS OR WORKMANSHIP.

UPON WRITTEN NOTIFICATION FROM THE CLIENT OR THE ARCHITECT THAT THE ABOVE WORK IS DEFECTIVE, ANY REPAIRS OR REPLACEMENT WORK REQUIRED SHALL BE TO THE ARCHITECT'S SATISFACTION AT NO COST TO THE CLIENT.

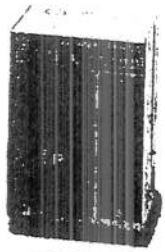
THIS GUARANTEE SHALL NOT APPLY TO DEFECTS CAUSED BY THE WORK OF OTHERS, MALTREATMENT OF MATERIALS, NEGLIGENCE OR ACTS OF GOD.

RICK SMITH

Rick Smith

PRESIDENT

Non-Reversing
Insta Kits (1)



LE1D●●362

Maximum HP 1 Phase 120V Hp	1 Phase 240V Hp	3 Phase 208V Hp	3 Phase 230V Hp	3 Phase 460V Hp	3 Phase 575V Hp	Assembly (2) (3)	NEMA Type 1 Catalogue Number (4)	Price	NEMA Type 12 Catalogue Number (4)	Price	NEMA Type 4 Catalogue Number (4)	Pr
0.5	1	2	2	5	7.5	Factory	LE1D09362●❑	$276.	LE1D09372●❑	$316.	LE1D09381●❑	
						Customer	LE1D09362K	204.	LE1D09372K	244.	-	
1	2	3	3	7.5	10	Factory	LE1D12362●❑	335.	LE1D12372●❑	375.	LE1D12381●❑	
						Customer	LE1D12362K	263.	LE1D12372K	303.	-	
1	3	5	5	10	15	Factory	LE1D18362●❑	369.	LE1D18372●❑	409.	LE1D18381●❑	
						Customer	LE1D18362K	289.	LE1D18372K	329.	-	
2	3	7.5	7.5	15	20	Factory	LE1D25362●❑	397.	LE1D25372●❑	493.	LE1D25381●❑	
						Customer	LE1D25362K	317.	LE1D25372K	413.	-	
2	5	10	10	20	25	Factory	LE1D32362●❑	514.	LE1D32372●❑	610.	LE1D32381●❑	
						Customer	LE1D32362K	400.	LE1D32372K	496.	-	
3	5	10	10	30	30	Factory	LE1D40362●❑	596.	LE1D40372●❑	772.	LE1D40381●❑	
						Customer	LE1D40362K	482.	LE1D40372K	658.	-	
3	7.5	10	15	40	40	Factory	LE1D50362●❑	679.	LE1D50372●❑	855.	LE1D50381●❑	
						Customer	LE1D50362K	509.	LE1D50372K	685.	-	
5	10	20	20	50	50	Factory	LE1D65362●❑	779.	LE1D65372●❑	955.	LE1D65381●❑	
						Customer	LE1D65362K	609.	LE1D65372K	785.	-	
7.5	15	25	30	60	60	Factory	LE1D80362●❑	855.	LE1D80372●❑	1031.	LE1D80381●❑	
						Customer	LE1D80362K	685.	LE1D80372K	861.	-	
-	-	30	40	75	75	Factory	LE1F11361●❑	1116.	LE1F11371●❑	1324.	LE1F11381●❑	
						Customer	-	-	-	-	-	
-	-	50	60	125	125	Factory	LE1F18361●❑	1756.	LE1F18371●❑	2104.	LE1F18381●❑	
						Customer	-	-	-	-	-	
-	-	60	75	150	150	Factory	LE1F26361●❑	2476.	LE1F26371●❑	3164.	LE1F26381●❑	
						Customer	-	-	-	-	-	
-	-	100	125	250	250	Factory	LE1F40361●❑	5792.	LE1F40371●❑	7552.	LE1F40381●❑	
						Customer	-	-	-	-	-	
-	-	150	200	400	400	Factory	LE1F50361●❑	16256.	LE1F50371●❑	18416.	LE1F50381●❑	
						Customer	-	-	-	-	-	
-	-	-	300	600	600	Factory	LE1F63361●❑	21592.	LE1F63371●❑	23752.	LE1F63381●❑	
						Customer	-	-	-	-	-	

(1) Instakits design available in NEMA Type 1 and Type 12 enclosures only. Size limited to D80 rating.

(2) Factory assembled:

a) Replace (●) with corresponding coil voltage code in the table below.

Voltage (volts)	24V	120V	208V	240V	480V	600V
Code	B	K	L	P	W	X

b) Replace (❑) with corresponding O/L relay suffix number listed on page 2/91 (Price included in starter price.)

(3) Customer Assembled:

a) For coil voltage other than 120 volts, select exact coil part number on page 2/69 to 2/70 or replace suffix letter K by corresponding letter on opposite coil voltage table.

b) Select exact O/L relay part number on page 2/89 and add price to starter price.

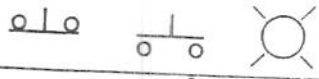
(4) To obtain a single phase non-reversing starter, change prefix LE1 to LES. (eg. LE1D09362K becomes LESD09362K). Price remains unchanged. Not applicable to LE1F● devices.

How to Order:

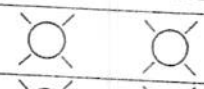
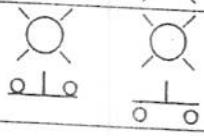
To Order Specify:	Example			
	Catalogue Number	Coil Voltage Code	Overload Relay Suffix	Factory Mods
• Catalogue Number • Coil Voltage Code • Overload Relay Suffix • Factory Modifications (alphabetical order)	LE1D09362	K	12	

Catalogue numbers ..... pages 2/115 - 2/125
Overload relays ..... pages 2/91 - 2/93
Factory Modifications ..... pages 2/126 - 2/133
Dimensions ..... pages 2/134 - 2/137
Wiring Diagrams ..... pages 2/138 - 2/139

One operator on cover

Symbol	Description	Colour	Nameplate	Assembly by	NEMA Type 1 Suffix/Cat. No. (3)	Price	NEMA Type 12 Suffix/Cat. No. (3)	Price
	Push button mushroom 40mm	Red	Emergency Stop	Factory	A06A	$40.	A07A	$
				Customer	-		-	
	Push button (double touch)	Black Red	Start Stop	Factory Customer	A06B	64.	A07B	17
					-		-	
	Push button (double touch)	Black Red	I O	Factory Customer	A06●	64.	A07●	9
					LA9AA0610	40.	LA9AA0610	4
	Push button (double touch) Pilot light (transformer type)	Black Red	Start Stop	Factory Customer	A06C	184.	-	
					-		-	
	2 Position selector switch	Black	Off On	Factory Customer	A06D	64.	A07D	17
					LA9AA06DT	40.	LA9AA06DT	4
	3 Position selector switch	Black	Hand off auto	Factory Customer	A06E	64.	A07E	17
					LA9AA06ET	58.	LA9AA06ET	6
	Pilot light (full voltage)	Green	Power on	Factory Customer	A06S	79.	A07S	17
	Pilot light (transformer type)	Green	Power on	Factory Customer	LA9AA06ST (2)	64.	LA9AA06ST (2)	6
					A06F	120.	A07F	21
					LA9AA06FT●	105.	LA9AA06FT●	10

Two operators on cover

	2 push buttons		Start Stop	Factory Customer	A06G	$64.	A07G	$17
					LA9AA06GT	58.	LA9AA06GT	5
	2 push buttons		I O	Factory Customer	A06T	64.	A07T	17
					-		-	
	2 position selector switch, Pilot light (transformer type)	Black Green	Off On	Factory Customer	A06H	184.	A07H	392
					LA9AA06HT● (1)	161.	LA9AA06HT● (1)	161
	2 position selector switch, Pilot light (full voltage)		Off-on Power on	Factory Customer	A06W	143.	A07W	351
					LA9AA06WT	120.	LA9AA06WT	120
	3 position selector switch, Pilot light (transformer type)		Hand off auto Power on	Factory Customer	A06J	184.	A07J	392
					LA9AA06JT● (1)	161.	LA9AA06JT● (1)	161
	3 position selector switch, Pilot light (full voltage)		Hand off auto Power on	Factory Customer	A06U	143.	A07U	351
					LA9AA06UT	120.	LA9AA06UT	120
	2 pilot lights (transformer type)	Green Red	Start Stop	Factory Customer	A06K	240.	A07K	432
					-		-	
	2 illuminated push buttons	Green Red	Start Stop	Factory Customer	A26G	480.	A27G	480
					-		-	

Note: To order a red "Emergency Stop" push button supplied as a factory modification, add the appropriate suffix to the end of the catalogue no. (see below)

(1) Replace (●) with coil voltage code corresponding to the pilot light voltage.

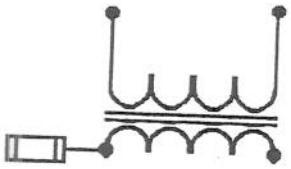
Voltage (volts)	24V	120V	208/240V	480V	600V
Code	B	K	P	W	X

(2) LA9AADIS3 or LA9AADIS5 adaptor needed.

(3) Catalogue number applies only to FVNR and FVR InstaKits starters.

Catalogue numbers ..... pages 2/115 - 2/125
Overload relays ..... pages 2/91 - 2/93
Factory Modifications ..... pages 2/126 - 2/133
Dimensions ..... pages 2/134 - 2/137
Wiring Diagrams ..... pages 2/138 - 2/139

Control Circuit Transformer*



Symbol	Description	VA	For Starter LE1, LE2, LES, LER	Assembly by	NEMA Type 1 and 12 Suffix/Cat. No. (2)
→	Full voltage starters (Standard VA capacity)	50	D09 - D32	Factory	A206●
				Customer	LA9TD32●
			D40 - D80	Factory	A206●
				Customer	LA9TD80●
		100	D18 - D32	Factory	A206●
				Customer	-
			F11 - F63	Factory	A206●
				Customer	-
	Full voltage starters + 100 VA extra capacity		D09 - D80	Factory	A208●
			D18 - D63	Customer	-
			F11 - F63	Factory	A208●
				Customer	-
	Full voltage starters special primary or secondary voltage		D09 - D80	Factory	A209●
			D18 - D63	Customer	-
			F11 - F63	Factory	A209●
				Customer	-
	Reduced voltage starters (Standard VA capacity)		LE3, LET, LEP D09 - D80	Factory	A406●
				Customer	-
			F11 - F63	Factory	A406●
				Customer	-
	Reduced voltage starters + 100 VA extra capacity		D09 - D80	Factory	A408●
				Customer	-
			F11 - F63	Factory	A408●
				Customer	-
	Reduced voltage starters special primary or secondary voltage		D09 - D80	Factory	A409●
				Customer	-
			F11 - F63	Factory	A409●
				Customer	-

Note: To order a control circuit transformer as a factory modification with 600V and 120V secondary, add the appropriate suffix to the end of the catalogue number. (see below)

* Prices include the secondary fuse; terminal not included.

(1) Replace (●) by corresponding suffix from table below.

(2) Catalogue number applies only to FVNR and FVR InstaKits starters.

50/100 VA	Primary				
Secondary	600V	480V	208V	240V	120V
120V	X	W	L	P	-
24V	A	B	D	C	E
			●		

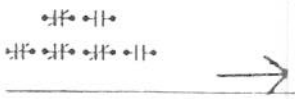
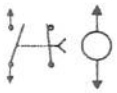
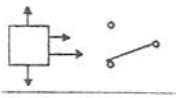
Catalogue numbers ..... pages 2/115 - 2/125
Overload relays ..... pages 2/91 - 2/93
Factory Modifications ..... pages 2/126 - 2/133
Dimensions ..... pages 2/134 - 2/137
Wiring Diagrams ..... pages 2/138 - 2/139

How to Order:

To Order Specify:	Example			
● Catalogue Number ● Coil Voltage Code ● Overload Relay Suffix ● Fuse Clip Suffix ● Factory Modifications (alphabetical order)	Catalogue Number	Coil Voltage Code	Overload Relay Suffix	Fac... Mo...
	LE1D09862	K	12	

Modifications

Control Circuit

Symbol	Description		For Starter	Assembly by	NEMA Type 1 and 12 Suffix/Cat. No. (2)	Price
	Auxiliary contact block (terminals and wiring not included)	2 contacts	All listed	Factory	A200	$88.
				Customer	LA1DN11	28.
		4 contacts	All listed	Factory	A400	176.
				Customer	LA1DN22	56.
	Auxiliary contact blocks on disconnect	NO or NC wired	All listed	Factory	A101	160.
				Customer	-	-
		NO or NC unwired	All listed	Factory	A102	88.
				Customer	-	-
	Auxiliary contact blocks on instantaneous trip circuit interrupter	NO or NC wired	All listed	Factory	A103	232.
				Customer	-	-
	Fuses for control circuit (terminals not included)	2 x 600V fuses	All listed	Factory	A104	176.
				Customer	-	-
		1 x 250V fuse	All listed	Factory	A105	88.
				Customer	-	-
		2 x 250V fuse	All listed	Factory	A106	176.
				Customer	-	
	Control circuit relay	4 poles unwired	All listed	Factory	A111	160.(1)
				Customer	-	-
		4 poles unwired (coil and 1 contact wired; terminals not included)	All listed	Factory	A112	424.(1)
				Customer	-	-
	Time delay relay	Unwired	All listed	Factory	A113	176.(1)
				Customer	-	-
		Wired (coil and 1 contact wired; terminals not included)	All listed	Factory	A114	360.(1)
				Customer	-	-
	Thermistor control relay, LT3II c/w 10 terminals max		All listed	Factory	A115	360.(1)
				Customer	-	-

Note: To order 2 auxiliary contacts supplied as a factory modification, add the appropriate suffix to the end of the catalogue number. (see below)

(1) Basic relay price must also be added to starter price.
(2) Catalogue number applies only to FVNR and FVR InstaKits starters.

... pages 2/115 - 2/125
... pages 2/91 - 2/93
...cations ... pages 2/126 - 2/133
ons ... pages 2/134 - 2/137
iagrams ... pages 2/138 - 2/139

How to Order:

To Order Specify:	Example			
• Catalogue Number • Coil Voltage Code • Overload Relay Suffix • Fuse Clip Suffix • Factory Modifications (alphabetical order)	Catalogue Number	Coil Voltage Code	Overload Relay Suffix	Factory Mod's
	LE1D09862	K	12	A200

Safety Switches
Heavy Duty

Single Throw - Fusible & Not Fusible
600 Volt, 3-Pole.

System	Amps	Ser.	Type 1	Ser.	Type 3R	Ser.	Type 4/4X Stainless Steel	Ser.	Type 3R/12	HP Rating 240 Vac Std.	240 Vac Max.	480 Vac Std.	480 Vac Max.	600Vac Std.	600Vac Max	250 Vdc Max	600 Vdc Max
3-Pole, Fusible																	
	30	F1	CH361	F1	CH361RB	E2	CH361DS	F1	CH361AWK	-	-	5	15	7.5	20	-	15
	60	F5	CH362	F5	CH362RB	E2	CH362DS	F5	CH362AWK	-	-	15	30	15	50	-	30
	100	F5	CH363	F5	CH363RB	E2	CH363DS	F5	CH363AWK	-	-	25	60	30	75	-	40
	200	E1	CH364	E1	CH364RB	E2	CH364DS	E2	CH364AWK	-	-	50	125	60	150	-	50
	400	E2	CH365	E2	CH365R	E2	CH365DS	E2	CH365AWK	-	-	100	250	125	350	50	-
	600	E2	CH366	E2	CH366R	E2	CH366DS	E2	CH366AWK	-	-	150	400	200	500	-	-
	800	E4	H367	E4	H367R	-	-	E4	H367AWK	-	-	200	500	250	500	50	50
	1200	E4	H368	E4	H368R	-	-	E4	H368AWK	-	-	300	500	250	500	50	50
3-Pole, Not Fusible																	
	30	F1	CHU361	F1	CHU361RB	E2	CHU361DS	F1	CHU361AWK	5	10	7 1/2	20	10	30	5	15
	60	F5	CHU362	F5	CHU362RB	E2	CHU362DS	F5	CHU362AWK	10	20	20	50	25	60	10	30
	100	F5	CHU363	F5	CHU363RB	E2	CHU363DS	F5	CHU363AWK	15	40	30	75	40	75	20	40
	200	E1	CHU364	E1	CHU364RB	E2	CHU364DS	E2	CHU364AWK	-	60	-	125	-	150	40	50
	400	E2	CHU365	E2	CHU365R	E2	CHU365DS	E2	CHU365AWK	-	125	-	250	-	350	50	-
	600	E2	CHU366	E2	CHU366R	E2	CHU366DS	E2	CHU366AWK	-	200	-	400	-	500	-	-
	800	E4	HU367	E4	HU367R	-	-	E4	HU367AWK	50	250	50	500	50	500	50	50
	1200	E4	HU368	E4	HU368R	-	-	E4	HU368AWK	50	250	50	500	50	500	50	50

- Type 3R switches with "RB" suffix are supplied with main entry hole cut in top endwall and closing cap (BCAP) installed. Hole accepts 3/4 in. to 2 1/2 in. hubs.
- Type 3R switches with "R" suffix have a blank endwall.
- Type 3R/12 switches are suitable for Type 3R application by removing the drainscrew from bottom endwall.
- "Ser." denotes the Series of the device. Please refer to this column when selecting accessories.
- Type 3R & 3R/12 switches are silicone free devices.

Application Information

- HP Ratings:
  - Standard - use code (Class H) fuses
  - Maximum - use time delay fuses
  - refer to latest design series only
- Use two outside poles for switching DC.
- Heavy Duty Switches have Quick-Make / Quick-Break, Load-Make / Load-Break operating mechanisms.
- All Type 4/4X and 3R/12 switches have, as standard, all copper current carrying components.
- For information regarding accessories and optional features, see pages DE2-20 to DE2-24.
- HP Rating: Standard value when using fast acting one time fuses. Max. value when using dual element time delay fuse.
- For more information consult Schneider Electric.

- Short Circuit Withstand Ratings

	RMS Symmetrical k Amps				
	Fuse Class				
Voltage	C	H	J	L	R
600 Vac	200	10	200	200	200

For pricing information please refer to List Price Book

Bom Name: CAPE DORSETT CDP-PA

Bom Sub-Name:

Item No.	Qty.	Catalog Number / Details
2-00	1	Designation: CDP-PA CDP PANELBOARD (INTERIOR) FEDERAL PIONEER CDP PANELBOARD CONSISTING OF 347/600 VAC 3PH 4W IC: 14K MAIN: 225A CJL-E BKR SERVICE ENT MAIN ACC: S/T(120VAC) INCOMING CABLES:(1)350 MCM BUS: CU MAIN BUS ENCLOSURE: TYPE 1 MOUNTING: SURFACE 40 X MOUNTING HEIGHT PANEL HEIGHT: "(mm) WIDTH: "(mm) DEPTH: "(mm) INCOMING: BOTTOM BRANCHES: 1 50A/2P CE-B 3 40A/3P CE-B 1 20A/3P CE-B 5 15A/1P FFG 3 15A/3P CE-B ADDITONAL FEATURES: PANELBOARD AVAILABITY SUBJECT TO ENGINEERING REVIEW MAIN GROUND LUG Estimated Ship Days (ARO): 30 Working Days

REV	DESCRIPTION	BY	DATE				

BRANCH NEUTRAL

X	ACCESSORIES	TYPE	RATING AMP/P
1			
3		CE-B	15/3
5			
7			
9		CE-B	15/3
11			
13		FFG	15/1
15			
17		CE-B	20/3
19			
21			
23		CE-B	40/3
25			
27		CE-B	50/2
29			
31	FILLER PLATE		
33	BRANCH MOUNTED MAIN SHUNT TRIP 120 VAC	CJL-E	225/3
35			
37			
39			

RATING AMP/P	TYPE	ACCESSORIES	X
		2X SPACE	2
			4
15/3	CE-B		6
			8
			10
15/1	FFG		12
15/1	FFG		14
15/1	FFG		16
15/1	FFG		18
			20
40/3	CE-B		22
			24
			26
40/3	CE-B		28
			30
		FILLER PLATE	32
			34
		4X SPACE	36
			38
			40

PHYSICAL DATA

- ENCLOSURE: TYPE 1
  SURFACE
  BOX DIMENSIONS - INCHES (MM)
  HEIGHT: " (mm)
  WIDTH: " (mm)
  DEPTH: " (mm)
- BUSSING COPPER BUS
- ADDITIONAL FEATURES
  MAIN GROUND LUG

ELECTRICAL DATA

- SYSTEM: 347/600 VAC 3PH 4W
  14,000 AMPS SYMS. SCCR
- MAIN: SERVICE ENTRANCE: CJL-E 225A
  ACC: TMS, S/T
  BOTTOM FEED
  INCOMING CABLE(S):
  (1) 350 MCM
- BRANCHES

SUMMATION:

1	50A/2P CE-B	3	40A/3P CE-B
1	20A/3P CE-B	5	15A/1P FFG
3	15A/3P CE-B		

JOB NAME:	KRT ELECTRICAL	EQUIPMENT DESIGNATION:	CDP-PA
JOB LOCATION:	NISKU ,	EQUIPMENT TYPE:	CDP PANELBOARD
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			FEDERAL PIONEER
DATE:	JULY 9 2002		SCHNEIDER CANADA
DRAWING STATUS:	QUOTE NOT FOR CONSTRUCTION	DWG: 015247919	PG 1 OF 1 REV 000

GUARDIT™

Owner's Manual

SINCE 1948

RACO

REMOTE ALARMS AND CONTROLS

Warranty

Raco Manufacturing and Engineering Co. Inc., warrants this product to be in good working order for a period of two years from the date of purchase as a new product. In the event of failure of any part(s) (excluding batteries), due to defect in material or workmanship occurring within that two year period, Raco will, at it's option repair or replace the product at no charge for parts or labor. All billable repairs after the two year period will carry a ninety day warranty. Any alteration of the product without instruction from Raco's Engineering Department will automatically void this warranty. If alterations of the unit are authorized by Raco, please complete the authorization form in the Owners Manual and return the form to Raco to ensure the warranty. Under no circumstances will Raco be responsible for consequential or secondary damages.

The defective product should be returned, insured and freight prepaid, securely packaged to the address listed below. Please call Customer Support at 800 449-4539 for a Return Authorization Number. Customer Support will be available from 8:00 a.m. to 4:30 p.m. (PST), Monday through Friday (excluding holidays). When you call Customer Support with a technical problem or to request a Return Authorization number please have the products serial number and a detailed description of the problem you are experiencing.

Raco Manufacturing and Engineering Co. Inc.
Customer Support
1400 62nd Street
Emeryville, California 94608

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FCC Notice to Users

1 Product Overview

1.1 Product Description

The Guard-It™ alarm autodialer is designed to monitor conditions at remote facilities and place alarm notification telephone calls to personnel, delivering specific pre-recorded messages.

Users may also call the product at any time from any telephone, to check for alarm conditions.

Four signal inputs are provided for monitoring. The signals which the user connects to these four inputs may be any combination of contact closure, digital logic level, or analog 4-20 ma current loop. In addition, the product monitors the 12 volt DC power connected to it, and if an optional rechargeable battery has been installed, it will place alarm calls to report power failures.

The product will work with any standard dial-up public telephone line, as well as with the available Cellularm™ option. Leased lines are not required.

Using a programming phone at the front panel. the user may pre-record informative, high-fidelity voice messages up to 12 seconds in length, for each of the four input channels, plus a station identification message which is played during every phone call.

The user may program up to 8 phone numbers, which may be up to 60 digits in length. The product may also be programmed to call numerical display pagers in addition to regular phone numbers.

If desired, the user may program a number of detail parameters such as alarm trip delays, ring answer delays, etc.

A special Call Progress function may be turned on, which allows the product to detect busy signals and move automatically to the next programmed phone number, delay the voice reporting until the called phone has answered, and move to the next phone number if a programmable maximum number of rings has been exceeded.

A phone line fault monitor function may also be turned on, which detects the disconnection or failure of the phone line.

Informative, multi-color front panel LED's advise local personnel at a glance of any problems.

The product may be mounted on a back surface, or flush into a larger front panel, or as a stand-alone circuit board.

The Guard-It™ autodialer is ruggedly built to a high standard of quality by the world leader in industrial alarm autodialers. It includes internal noise filters and surge protection on all signal, power and phone line inputs, and is built for many years of reliable service.

1.2 Manual Description

This manual guides you through the following procedures:

- Location and mounting
- Initial programming
- Voice message recording
- Using Your Guard-It™ autodialer
- Advanced programming

A glossary explaining the terms used in this manual is included the end of the manual, along with a troubleshooting guide, an index, a return authorization form, and FCC notice to users.

Worksheets are provided to document and clarify your programming and message recording steps.

Please take a moment to read, complete, and mail the warranty registration card at the back of this manual.

1.2.2 Conventions

Throughout this manual various icons are used to visually identify information. They are as follows:

◆ The solid diamond symbol shows a list of procedures, decisions, or single step tasks.

● The bullet symbol shows a list of items.

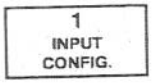
The bomb indicates a warning message. The information concerns process that may result in damage to equipment or harm to a person.

The hand indicates a caution message. The information concerns a process that may result in equipment failure.

The pencil indicates general information.

The open diamond pattern indicates one or more exceptions or special considerations for a process.

The phone indicates that you can access the Guard-It™ autodialer through your phone.



Other icons include menu indicators as seen on the Guard-It™ autodialer front panel.

"items in quotes"	Quotation marks indicate titles of sections and messages.
italic	Italic text indicates items for emphasis, message text, and sample text.
ALL CAPITALS	Capital letters reference the names of keys, lights, and LEDs.
Initial Capital Letters	Capitalization of the first letter of a set of words indicates mode and function types.

2 Installation

2.1 Mounting Location

Ideally, the Guard-It™ autodialer and the wiring connected to it should be located away from heavy duty power wiring and wiring which is likely to emit substantial electrical interference. The location must be free of condensing moisture, and must remain within a temperature range of 20 to 120 degrees F for proper operation. Allow clearance room for the plug-on connector block and phone line connectors at the bottom.

The product should be located within 5 feet of an RJ11 telephone line jack, otherwise a telephone extension cord will be needed to make the phone line connection.

If you are using the optional 12 VDC wall adaptor to power the product, you will need a 120 VAC electrical outlet to plug the adaptor into. The product should be located within five feet of this outlet; otherwise it may be necessary to splice in additional wire length for the 12 VDC line.

2.2 Mounting Onto A Back Surface

Referring to the diagram, attach the mounting brackets to the product. Prepare the back surface by drilling pilot or clearance holes for the mounting screws. The mounting centers are 3.6" high by 9" wide. #8 Wood screws, self tapping screws and machine screws (with lock washers and nuts) are provided to accommodate a variety of back panel materials. Refer to the diagram (See Appendix F).

2.3 Mounting Flush Into A Front Panel

To mount the product flush into a larger front panel (maximum panel thickness 1/8"), you will need a rectangular cutout in the panel to clear 6-3/16" high by 8-3/16" wide. Slide the product into the opening from the front, and use the 6-32 screws to attach the two mounting brackets to the product in the proper orientation so that they hold the product firmly in place against the larger front panel. Refer to the diagram (See Appendix F).

2.4 Mounting Without An Enclosure

To mount the product as a circuit board only, open the enclosure via the two screws on each side of the enclosure, lift out the front panel, and then remove the four screws which secure the circuit board to the front panel. Pass appropriate mounting screws (not provided with product) through the white nylon standoffs to mount the circuit board to a back surface. The small inner panel is printed with markings to identify the LED's and switch functions.

2.5 Mounting With Cellularm™ Option

If your Guard-It™ autodialer was ordered with the Cellularm™ (cellular wireless) option, the product comes pre-mounted in the Cellularm™ enclosure. Follow the mounting instructions provided for the Cellularm™ option. Refer to the diagram (See Appendix F).

3 Wiring Connections

Note:

Note that the connector block is unpluggable for convenience in making wiring connections.

3.1 Power Connections

The Guard-It™ autodialer requires 8 to 16 VDC power connected to the connector block, in order to operate.

The power source should be capable of delivering a current of 500 milliamperes.

Power must be connected observing the correct polarity. Refer to the diagram.

3.2 Connecting To Electrical Ground

Your Guard-It™ autodialer has several internal protective devices built in. However, for them to work effectively it is important that the product be well grounded. A grounding wire with a terminal lug is included on the product for this purpose.

If the Product is mounted to a grounded metal back surface, then simply connect the terminal end of the wire to the lower right hand mounting screw as shown in the diagram.

If the product is not mounted to a grounded metal back surface, connect the end of the wire to the nearest available electrical grounding point. If the installation is within a grounded metal electrical panel or enclosure, connecting to the metalwork will be sufficient. If you need to extend the ground wire, use 18 gauge wire or heavier, and keep the total length as short as possible.

This grounding wire will also ground the (-) side of the incoming 12 VDC power. If you are using a pre-existing source of 12 VDC power, you will need to verify that the grounding of the (-) side of this supply will not cause a problem.

3.3 Phone Line Connection

Plug one end of the supplied telephone extension cord into the telephone line jack located to the left of the connector block (not the programming jack located on the front panel). Plug the other end of this same cable into a telephone line (RJ11) jack.

Caution:

The phone line must be such that a standard telephone set can work on it. *Certain in-house PABX phone systems have "digital" line connections which can damage the product!*

Ideally this phone line should be for the exclusive use of the Guard-It™ autodialer. However, the product will generally function if there is an extension phone on the same line, as long as that extension phone is not in use when it is time for the Guard-It™ to place or receive a phone call.

3.4 Input Signal Connections

The four signal inputs on the Product can be used with several different types of input signals, in any combination.

3.5 Connecting Unpowered ("DRY") Contact Inputs

Connect unpowered contact inputs as shown in the diagram. Each input has two input connection points. The points marked "C" are internally connected together and to common ground.

Warning:

Before making any such connections, verify that there is *no electrical power present on the signal wires,* otherwise serious damage to the product could result.

3.6 Connecting Analog or Digital Logic Signal Inputs

Refer to Appendix A regarding analog signal inputs and Appendix B regarding digital logic signal inputs.

3.7 Optional Digital Alarm Output (DAO) Connections

The digital alarm output circuit activates whenever there is an unacknowledged alarm. It deactivates whenever such alarms are acknowledged. It may be used to power a customer supplied 12 VDC relay, or to drive a 5 volt logic circuit. See appendix C for details.

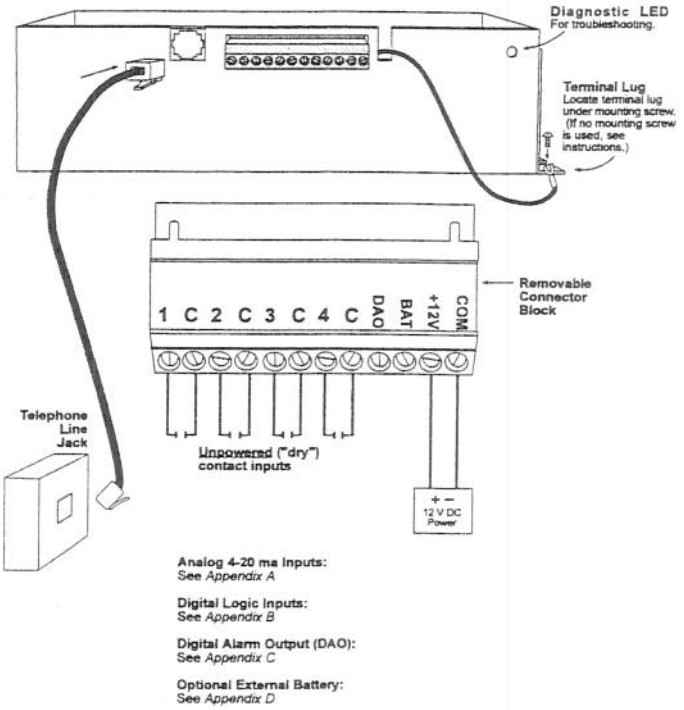
3.8 Optional External Battery Connections

The Product may be used with a customer-supplied external 6 VDC (not 12 VDC) gel cell lead acid battery for backup during power failure. An internally mounted gel cell battery is also an available as an option from Raco. Refer to appendix D if using an external gel cell battery.

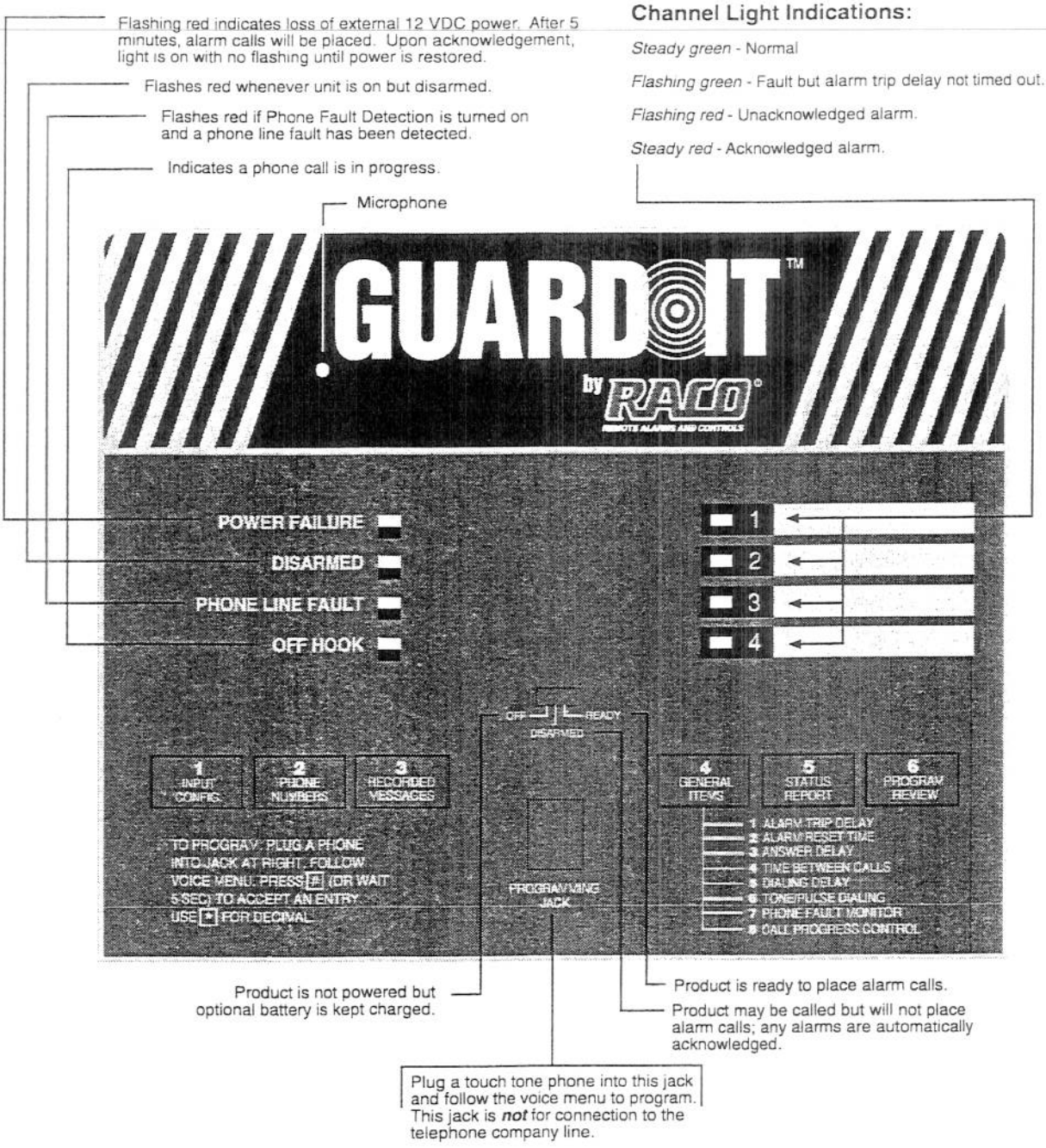
3.9 Writing Channel Descriptions In White Bar Areas

You may want to use the white bar area to the right of each of the four input channel status LED's, to write in short descriptions of what each input channel is being used to monitor. You may use a plain lead pencil (which is erasable), or a marker pen.

Basic Wiring Connection Diagram



Guard-It™ Front Panel Diagram



4 Programming Your Guard-It™ Autodialer

4.1 Programming Menu

To program your Guard-It™ autodialer, you will need a standard touch-tone telephone.

Telephones which have the keypad located separately from the handset, are most convenient for this purpose.

Just plug the telephone temporarily into the Programming Jack on the front panel of the product, lift the receiver, and follow the voice menu to enter your programming and record your voice messages.

If you do not make any selection from the "top" menu, it will be repeated once and then the program mode will be terminated.

To begin again, simply hang up the programming phone for a second or so, and then pick it up again. You may do this from most places in the programming menu, whenever you want a fresh start.

For most programming items, you will hear the present programming entry if any, and then you will be given a chance to either accept this existing entry by pressing pound (#), or else make a new entry.

If you make a new entry, it will be repeated back to you for confirmation.

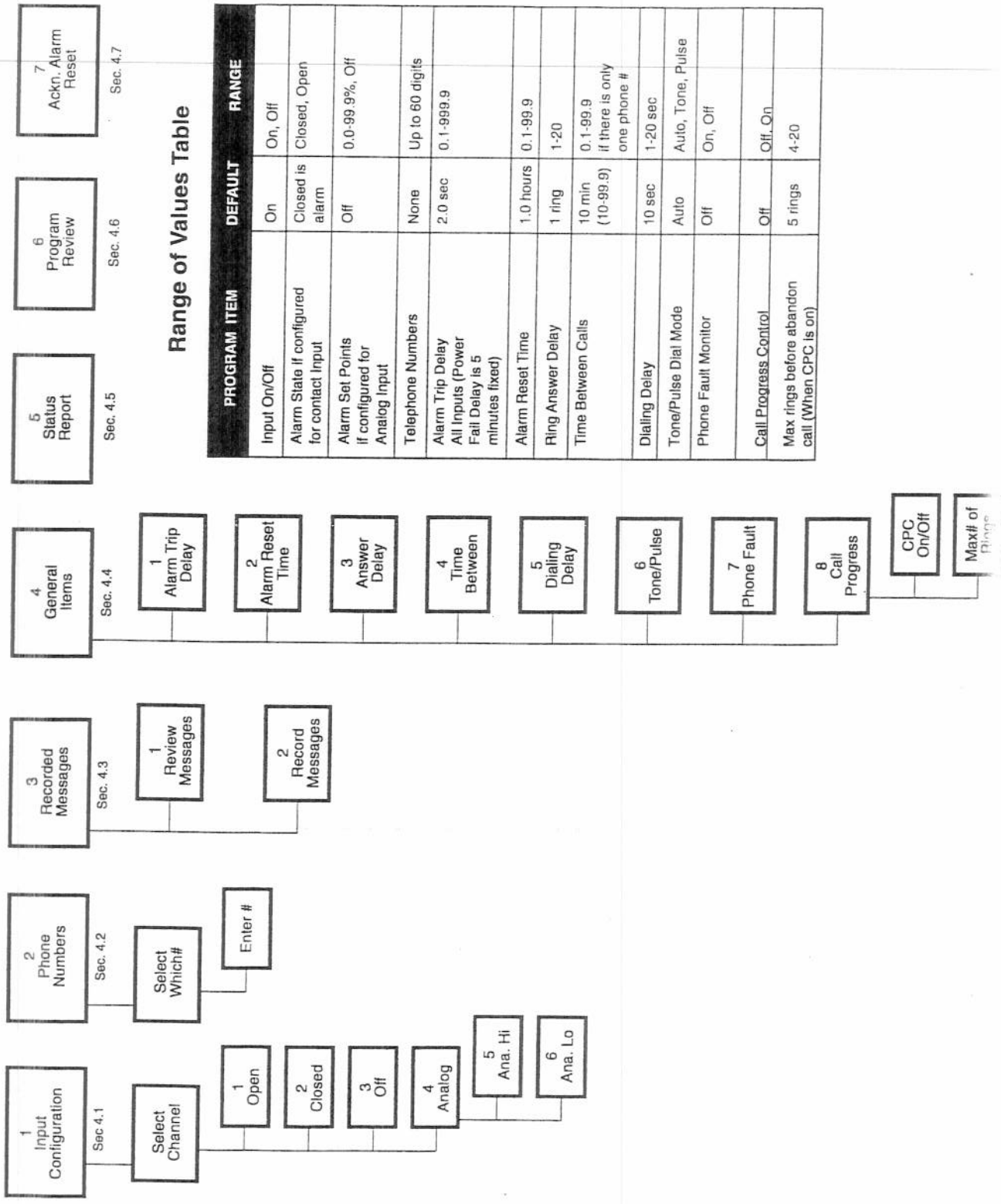
In general, pressing the pound (#) key will cause whatever you have keyed in to be accepted and recited back for confirmation.

When keying in a menu choice rather than a value, the choice will be accepted and recited without need to press pound (#).

Pressing the pound (#) key when you have not keyed in any entry, will generally return you to the previous menu level.

If you make an entry that the Product considers invalid, it will respond with a statement, *"Value fault. Enter a new value."* The previous valid setting will be retained and restated, and then you will be prompted to make a new entry if you wish to do so. This would occur, for example, if you entered a value that was outside the allowable range of values for that programming item.

Guard-It™ Programming Flow Chart



Range of Values Table

PROGRAM ITEM	DEFAULT	RANGE
Input On/Off	On	On, Off
Alarm State If configured for contact Input	Closed is alarm	Closed, Open
Alarm Set Points If configured for Analog Input	Off	0.0-99.9%, Off
Telephone Numbers	None	Up to 60 digits
Alarm Trip Delay All Inputs (Power Fail Delay is 5 minutes fixed)	2.0 sec	0.1-999.9
Alarm Reset Time	1.0 hours	0.1-99.9
Ring Answer Delay	1 ring	1-20
Time Between Calls	10 min (10-99.9)	0.1-99.9 if there is only one phone #
Dialing Delay	10 sec	1-20 sec
Tone/Pulse Dial Mode	Auto	Auto, Tone, Pulse
Phone Fault Monitor	Off	On, Off
Call Progress Control	Off	Off, On
Max rings before abandon call (When CPC is on)	5 rings	4-20

Refer to the table later in this section, for a listing of the initial default values and allowable range of values which you can program, for each programming item.

Note:

If you delay more than five seconds without pressing any new key, the Product will treat this the same as pressing the pound (#) key, except when recording messages.

Also note that your Guard-It™ autodialer will not respond to new alarm conditions while you are programming. The LED's will generally remain in the state they were in prior to the beginning of the programming session, until a few seconds after the programming session has ended. Most program changes do not take effect until you end the programming session. The same is true during an alarm call; messages for new alarms are not included in a call that is already underway.

4.1.1 Input Configuration

1 INPUT CONFIG.

The default input configuration for each of the four input channels is *contact input, alarming on closed circuit.*

If you need a different configuration, after selecting [1] from the top menu, you must select which of the four available input channels (first, second, etc.) you want to configure. The voice menu will ask you for this number which will be a number from 1 to 4.

After you select the input channel number to configure, the voice menu will prompt you with the following choices:

- [1] Alarm on Open Circuit
- [2] Alarm on Closed Circuit (which is the default setting)
- [3] Off (so that this input channel will not report or activate its corresponding front panel LED)
- [4] Analog (4-20 ma current loop) signal.

If an input channel is configured for an analog signal, the menu also gives you two additional choices:

- [5] To program an analog high alarm level set point value
- [6] To program an analog low alarm level set point value

Example:

To configure input channel 3 to alarm on Open Circuit, from the top menu press:

```
1 3 1
```

Refer to Appendix A for additional information on programming for analog signal inputs.

4.1.2 Phone Number Programming

2 PHONE NUMBERS

You must program at least one phone number for your Guard-It™ autodialer to dial when it has an alarm to report.

Note:

Until you do so, any alarms which are detected will be automatically acknowledged without any alarm calls being placed.

To program phone numbers, you must first select which of 8 available phone numbers (first, second, etc.) you want to program. The voice menu will ask you for this number, which will be a number from 1 to 8. Then it will recite the presently programmed phone number for that selection, if any. Then it will allow you to accept the current entry by pressing pound (#), or else enter a new phone number for that selection.

Be sure to include any necessary prefixes or area codes, just as you would dial it on an ordinary telephone.

As you enter each digit, be sure to listen for the voice to repeat back that digit, before you enter the next digit.

Example:

To program the third phone number to be 1 (510) 658-6713, from the top menu you would press [2] for phone number programming, then [3] to select the third phone number, then:

```
1  5  1  0  6  5  8  6  7  1  3  #
```

Listen carefully as the completed entry is repeated back to you, to be sure it was entered and accepted correctly.

To delete a phone number, program it to be 00.

For example, to clear out the fourth phone number, from the top menu you would press [2] for phone number programming, then [4] to select the fourth phone number, then:

```
0 0 #.
```

To program a phone number for use with numeric pagers, see Appendix E.

4.1.3 Recording Voice Messages

3 RECORDED MESSAGES

Your Guard-It™ autodialer has "canned" generic alarm messages ("Channel one alarm", etc.) but you will probably want to record your own more specific and informative alarm messages.

There are five alarm messages which you can record: a message for each of the four input channels, plus a "Station ID" message which identifies the site where the Product is located.

In order to prevent one message from being recorded or re-recorded over another message, *it is necessary to record all five messages, in proper order, in one sequence of steps.*

Under the Message Review and Recording menu which you get by pressing [3] from the top menu, you will be prompted to choose:

- [1] to review the existing set of five messages, or
- [2] to begin the sequence of recording all five messages.

If you select [2] to begin the recording sequence, the Guard-It™ autodialer moves you automatically through the sequence of all five messages to record, starting with the message for input channel number one.

The voice menu identifies which message is to be recorded next (i.e. for input channel number 1, for input channel number 2, etc.).

To actually record the message, wait for the sound of the beep, then speak clearly into the telephone mouthpiece of the programming phone. When you are done, press pound (#). The Product will then play back the message you have just recorded.

If you want to re-record the resulting message after hearing it played back, press star (*) instead of pound (#). You may re-record as many times as you wish, until you are satisfied with a given message. When you are satisfied with the message, press pound (#) to move on to the next message.

Proceed in this manner to record *all five messages*. The Station ID message is the last message in the set of five messages. It is the message that will be recited during every phone call, to identify the site that is calling or being called.

If you have configured a given input channel as "OFF", you will still be asked to record a message for it. Just "record" a moment of silence for that departed input channel, and proceed with recording the remaining messages.

For any input channels which you have programmed for analog signal input, record the message in the form of: "The water level percentage is". Whenever you call in or when an alarm call is placed, analog channels will be reported with the message you record followed immediately by the percentage value. You may want to include a spoken reference to the translation table which is found in Appendix A.

If you later need to change a message, simply re-record the entire set of 5 messages.

Each message may be as long as 12 seconds, for an available total of 60 seconds.

4.1.4 General Programming Items

4 GENERAL ITEMS

The following general programming items allow you to "custom tailor" some specialized aspects of product operation.

Many users will find that the default settings work well, without need to program any of the items in this general category.

4.1.4.1 [1] Alarm Trip Delay

The alarm trip delay is the number of seconds during which the alarm violation (fault) must be continuously present on any input channel, before the Product will trip that input channel into Unacknowledged Alarm condition and begin dialing the first programmed phone number.

The default value is two seconds. If you wish to alter this value, the range of programmable values is 0.1 to 999.9 seconds. Use the star (*) key if you want to use a decimal point, but it is also OK to use whole numbers.

During the time period when a fault exists but has not yet lasted long enough to trip an alarm, the LED for that input channel will change from green to flashing green. Also during this interval, if you should hear a spoken status report on this channel, the word "fault" will be added to the message.

Note that the Product also has an internal power failure alarm. The trip delay for this alarm is fixed at 5 minutes.

4.1.4.2 [2] Alarm Reset Time

In the Unacknowledged Alarm state, the Product will place alarm calls, going endlessly through the list of up to 8 programmed phone numbers until the alarm is acknowledged by someone pressing a "9" at the sound of the tone, or by placing a return call to the Product and pressing "9" at the sound of the tone.

Either way, when the alarm is acknowledged, further alarm calls on behalf of that input channel (or power failure alarm) will be suspended. An internal Alarm Reset Timer begins timing, and when it has completely timed out, the acknowledged alarm status for that input channel is automatically cleared. As a result, if there is no current alarm condition, no new alarm will be created. If an alarm condition does still exist, then after the alarm trip delay expires, a new Unacknowledged Alarm and alarm calling will occur.

The default value for the Alarm Reset Time is one hour. If you wish to alter this value, the range of programmable values is 0.1 to 99.9 hours. Use the star (*) key if you want to use a decimal point, but it is also OK to use whole numbers.

Note:

Note that when testing, once you trip an alarm on a given input channel and acknowledge the alarm, you will not be able to promptly re-create an Unacknowledged Alarm for that input channel, since the Alarm Reset Timer will not have timed out, and this input channel will still be in an Acknowledged Alarm state. To create a new alarm, you can trip an alarm on another input, or you can force a clearout of all Alarm Reset Timers by using selection [7] on the top menu, or by turning the product off and then on again.

4.1.4.3 [3] Answer Delay

When you place a call to the Product, it will wait for a programmed number of rings before answering the call. This number of rings is called the Answer Delay.

The default value is one ring. If you wish to alter this value, the range of programmable values is 1 to 20 rings.

Note About Extension Phones:

The best practice is to provide a phone line service for the exclusive use of the Guard-It™ autodialer. However, if you do need to have an extension phone on the same line for use by personnel, you might want to program a ring delay of, say, 6 rings, so that anyone present at the site would have a chance to answer the call before the Guard-It™ autodialer answers it. If the line is in use by an extension phone when the Guard-It™ tries to place an alarm call, the call will not be completed, but the messages will be heard on the extension phone.

4.1.4.4 [4] Time Between Alarms Calls

After the Product is finished placing a call to a given phone number, and if the alarm was not acknowledged during that call, the Product enters a waiting period before it begins placing the next alarm call. This waiting period is the Time Between Alarm Calls.

The default value is 10.0 minutes. If you wish to alter this value, the range of programmable values is 0.1 to 99.9 minutes.

Note, however, that in order to comply with governmental regulations for alarm autodialers, if only one phone number is programmed, the product will not alllow the time between alarm calls to be less than 10 minutes.

4.1.4.5 [5] Dialing Delay

If you want your Guard-It™ autodialer to place alarm calls to a numerical pager, you will need to refer to Appendix E for special instructions, which include programming the special Dialing Delay.

The default value is 10 seconds. If you wish to alter this value, the range of programmable values is 1 to 20 seconds.

4.1.4.6 [6] Tone/Pulse Dialing

Your Guard-It™ autodialer is capable of dialing using Pulse Dialing or Tone Dialing.

- For Tone Dialing, press [1]
- For Pulse Dialing, press [2].
- For "Auto Detect," press [3]. This is the default setting.

When Auto-Detect is chosen, the Product will periodically test the phone line and it will automatically use Tone Dialing if it determines that Tone Dialing works on the phone service line it is connected to.

4.1.4.7 [7] Phone Fault Monitor

Occasionally a telephone line will cease to operate. When the Phone Fault Monitor function is turned on, the Product will go "off hook" to check for the presence of a dial tone. If it fails to hear a dial tone, it begins flashing the "PHONE LINE FAULT" LED on the front panel, and continues to do so until such later time as it again hears a dial tone during another periodic check.

This action of going off hook every few minutes (as indicated by the yellow light on the front panel) may make it seem like the product is behaving erratically, to someone who is not familiar with its functioning.

Because the line is checked only periodically, if there is a change in the status of the phone line connection, *it will take a few minutes for the LED to reflect the change.*

Note:

Note that if this feature is turned on and there is another phone device connected to the Guard-It™ autodialer's phone line, if that device happens to be "off hook" (in use) when the product checks the phone line, a phone line fault indication may occur.

Even if the product has detected an apparent phone line fault, if it needs to place an alarm call it will attempt to do so. Thus in some circumstances during a call to or from the product, you might hear the message "phone line fault, now normal." This generally would mean that a phone extension was in use at last check, or that the phone line is intermittent and should be checked.

When the product has detected a phone line fault and then subsequently finds the line to be operational, the warning LED will be turned off. However the verbal warning will be retained until after you either place a call to the product, or acknowledge an alarm call.

Detection of a phone line fault will not cause an attempt to place alarm calls.

The default setting for this feature is "Off". To turn it on, when prompted press [1].

4.1.4.8 [8] Call Progress Control and "Maximum Number of Rings"

The Guard-It™ autodialer can be programmed to monitor the progress of the alarm calls it places, by listening to the tones and voice signals on the phone line.

Based on the signals the product hears, it knows when to start delivering its messages, and it also knows if it should abandon the current call attempt, as described below.

If Call Progress Control is turned on, when placing alarm calls the product counts the number of ring signals it hears. If more than the programmed "Maximum Number of Rings" occurs with no answer, it ends the phone call attempt without issuing any spoken message. It then waits the programmed Time Between Alarm Calls, before placing a call to the next phone number.

If Call Progress Control is turned on, the programming menu will allow you to program this "Maximum Number of Rings." The default value is 5 rings. If you wish to alter this value, the range of programmable values is 4 to 20 rings.

Also when Call Progress Control is turned on, when placing alarm calls the product listens for the ring signals, and only begins speaking when it misses the sound of the next ring. For this reason, there may be a delay of a few seconds after picking up the phone, before the first message is heard, when this function is turned on.

Also when Call Progress Control is turned on, when placing alarm calls the product listens for a busy signal. If it hears a busy signal it immediately ends the call and waits the programmed Time Between Alarm Calls, before placing a call to the next phone number.

The default setting for Call Progress Control is "off".

Call Progress Control depends upon the product's ability to interpret the various tone signals heard on the phone line. Because there is a lot of variance in the nature of these signals from one local phone company to another, it is important to thoroughly test the proper functioning of Call Progress Control, if you choose to turn this feature on.

4.1.5 Status Report (Input Review)

5 STATUS REPORT

This selection in the top menu causes the Guard-it™ to recite the status of any input channels which are in any kind of non-normal state. Any channels which have been programmed "off" will not be mentioned.

4.1.6 Programming Review

6 PROGRAM REVIEW

This feature allows you to review all the programming settings. Any messages which you have recorded will also be recited. We suggest that you use this feature to write all your programming entries on the **Programming Log Sheet** provided in this manual. This will allow you to easily re-create your Guard-It™ autodialer setup should it ever be necessary to replace or reprogram the unit. It is also helpful in the event you need to call for Customer Support.

4.1.7 Acknowledged Alarm Reset

Note:

Note that unlike the other six menu choices, this choice is not printed on the front label of the product.

As previously mentioned, under test conditions you cannot quickly recreate an unacknowledged alarm on a given input when that input is already in an Acknowledged Alarm state. The reset feature allows you to force a clearout of the alarm reset timers, so that all input channels (and power failure alarm) are immediately ready to be tripped into Unacknowledged Alarm for the purpose of further testing or alarm monitoring.

4.2 Restoring Programming To Factory Default Settings

It is possible to restore your Guard-It™ autodialer to factory default settings for all programming items, including clearing out all recorded messages.

To do this, locate the plugged hole in the top of the enclosure, and remove the plug. While the product is turned on (but not in programming mode), use a screwdriver blade or similar device to momentarily connect the two pins which are accessible through the hole.

The four input channel LED's will turn orange while the unit "reprograms" itself to factory default settings. When this process is completed, the LED's are restored to their normal color and the product is ready for new programming.

4.2.1 Programming Log Sheet

Range of Values Table

PROGRAM ITEM	DEFAULT	RANGE	REPROGRAMMED TO:
Input On/Off	On	On, Off	
Alarm State if configured for contact Input	Closed is alarm	Closed, Open	
Alarm Set Points if configured for Analog Input	Off	0.0-99.9%, Off	
Telephone Numbers	None	Up to 60 digits	
Alarm Trip Delay All Inputs (Power Fail Delay is 5 minutess fixed)	2.0 sec	0.1-999.9	
Alarm Reset Time	1.0 hours	0.1-99.9	
Ring Answer Delay	1 ring	1-20	
Time Between Alarm Calls	10 min (10-99.9)	0.1-99.9 if there is only one phone #	
Interdigit Dialing Delay	10 sec	0-99.9 sec	
Tone/Pulse Dial Mode	Auto	Auto, Tone, Pulse	
Phone Line Alarm On/Off	Off	On, Off	
Call Progress Monitoring	Off	Off, On	
Max rings before abandon call (When CPM is on)	5 rings	4-20	

PROGRAMMING LOG SHEET

PROGRAM ITEM	DEFAULT	RANGE	REPROGRAMMED TO:
Input Channel 1	Alarm on Closed Circuit	Analog, Alarm Closed, Alarm Open, Off	Closed ☐ Open ☐ Analog ☐ Off ☐ _____% _____% High Set Point Low Set Point
Input Channel 2	Alarm on Closed Circuit	Closed, Open	Closed ☐ Open ☐ Analog ☐ Off ☐ _____% _____% High Set Point Low Set Point
Input Channel 3	Alarm on Closed Circuit	Analog, Alarm Closed, Alarm Open, Off	Closed ☐ Open ☐ Analog ☐ Off ☐ _____% _____% High Set Point Low Set Point
Input Channel 4	Alarm on Closed Circuit	Analog, Alarm Closed, Alarm Open, Off	Closed ☐ Open ☐ Analog ☐ Off ☐ _____% _____% High Set Point Low Set Point
Phone Number 1			
Phone Number 2			
Phone Number 3			
Phone Number 4			
Phone Number 5			
Phone Number 6			
Phone Number 7			
Phone Number 8			
Message for Input 1	Channel 1 Alarm		
Message for Input 2	Channel 2 Alarm		
Message for Input 3	Channel 3 Alarm		
Message for Input 4	Channel 4 Alarm		
Message for Station ID	This is Phone Alarm Station		

PROGRAM ITEM	DEFAULT	RANGE	REPROGRAMMED TO:
Ring Answer Delay	1 ring	1-20	
Time Between Callls	2.0 seconds	0.1-999.9[1]	
Alarm Reset Time	1.0 hours	0.1-99.9	
Tone/Pulse Dialing	Auto detect	Tone, Pulse, Auto	
Pager Dialing Delay	10.0 seconds	0.1-99.9	
Phone Line Fault Monitor	Off	On, Off	
Call Progress Monitor	Off	On, Off	
Max Rings Before Abandon Call Atempt [3]	5	4-20	
Input Channel 4	Alarm on Closed Circuit	Analog, Alarm Closed, Alarm Open, Off	

Notes:

[1] For power failure alarm, Alarm Trip Delay is fixed at 5 minutes.

[2] Minimum programmable Time Between Calls is 10 minutes, if only one phone number is programmed.

[3] Call Progress Monitoring must be On for this to apply.

5 The Guard-It™ Autodialer In Operation

5.1 The Alarm Process

Much of the operation of the Guard-it™ was explained in the previous chapter on programming.

To review the sequence of events that starts with the detection of a fault condition on a given input channel, refer to the Alarm Process diagram.

Please keep in mind the following facts:

A fault condition must be detected continuously for the duration of the programmed Alarm Trip Delay, before an Unacknowledged Alarm will occur. During this timeout, the corresponding input channel LED will blink green.

The Alarm Trip Delay for input channels is programmable, with a default value of 2 seconds. For power failure alarm, the Alarm Trip Delay is fixed at 5 minutes.

Once an Unacknowledged Alarm occurs, the corresponding LED will blink red, and alarm calls will be placed indefinitely until the alarm is acknowledged, even if the fault condition returns to normal.

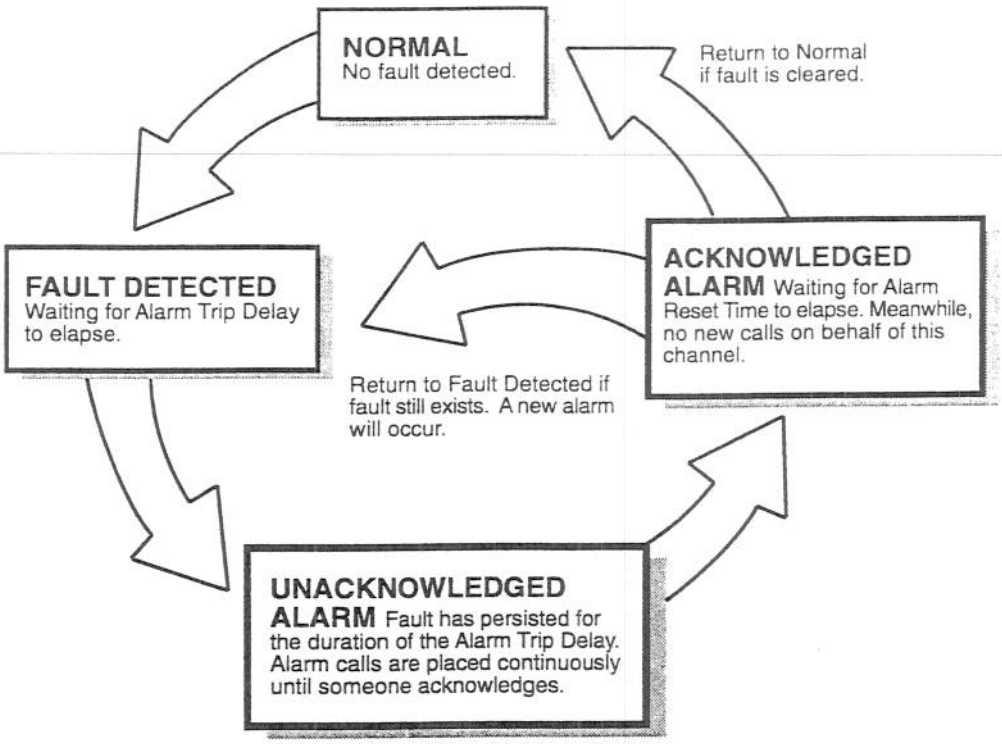
When the alarm is acknowledged, the corresponding LED turns solid red, and further alarm calls on behalf of that input channel (or power failure alarm) will be suspended.

At the moment of acknowledgment, an internal Alarm Reset Timer begins timing, and when it has completely timed out, the acknowledged alarm status for that input channel is automatically cleared. As a result, if the fault condition no longer exists, no new alarm will be created. If a fault condition does still exist, then after the alarm trip delay elapses, a new Unacknowledged Alarm and a new cycle of alarm calling will occur.

If the product loses all power or is turned off, when power is restored the acknowledged alarm status will have been cleared. Therefore, if a fault is still present, then after the alarm trip delay has elapsed, a new unacknowledged alarm will occur, resulting in new calls being placed.

If the OFF/DISARMED/READY switch on the front panel is in the DISARMED position, any such alarm will be automatically acknowledged so that no alarm calls will be placed.

Guard-It™ Alarm Process Diagram



Channel Light (LED) Indications:

Steady green - Normal

Flashing green - Fault detected but alarm trip delay not timed out.

Flashing red - Unacknowledged alarm.

Steady red - Acknowledged alarm.

Power Failure Alarm (LED) Indications:

Flashing red indicates loss of external 12 VDC power. After 5 minutes, alarm calls will be placed. Upon acknowledgement, light is on with no flashing until powered is restored.

If the phone line connected to the Guard-it™ autodialer has an extension phone and it is in use at the time the product attempts to place an alarm call, the call will not go through to the programmed phone number, but the alarm message will be superimposed on the phone call in progress on the extension phone.

Note that the alarm reset function is somewhat similar to a "snooze alarm" on an alarm clock. If someone acknowledges an alarm but does not correct the condition, a new series of calls will be placed after a "snoozing" period has elapsed.

5.2 Receiving And Acknowledging An Alarm Call

When you receive an alarm call from your Guard-it™ autodialer, listen to the message to learn what alarm(s) exist. The message round will start with the Station ID message, followed by the specific alarm message for the input channel(s) in alarm, and/or a message stating "power is off".

Note that any input channels which have been programmed for analog, will be reported regardless of whether they are in alarm or not. If there is a high or low level alarm on an analog channel, the words "high (or low) level alarm" will be added.

The additionally informative words "fault", "now normal", and "acknowledged" may be added as follows:

If the input of a given input channel is in fault but has not yet persisted long enough to trip an alarm for that input, the message for that input will be included with the word "fault" added.

If the input of a given channel in alarm has returned to normal as of the time of the phone call, the message for that input will be included with the words "now normal" added.

If a given input channel is already in an acknowledged alarm state, the message for that input will be included with the word "acknowledged" added.

At certain points in the message round, a prompting beep will be issued. This is your cue to press a "9" immediately after the tone to acknowledge the alarm. Upon detecting the "9", the Product will say "Alarm is acknowledged. Goodbye", and the call will end.

Following the final message round, the microphone will be turned on so that you can hear sounds occurring in the area of the product. Then there will be one last beep to allow acknowledgment before the call ends.

If you do not acknowledge an alarm call, the Product will end the call and wait for the programmed Time Between Alarm Calls (default 10 minutes), before going on to place a call to the next programmed phone number, repeating the calling endlessly until the alarm is acknowledged.

If the Call Progress Monitoring function is not turned on, you will generally pick up the phone in the middle of a message. Simply continue to listen, and the message will continue to the start of a complete new round.

If the Call Progress Monitoring function is turned on, there may be a delay when you answer the phone, before the messages begin.

You may also acknowledge the alarm by placing a return call to the Guard-it™ autodialer. The best way to do this is to wait for the alarm call to end before you place your return call, so that the line will not be busy. At the sound of the prompting beep, press a "9", and the Product will respond by saying "Alarm is acknowledged. Goodbye."

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5.3 Power Failure Alarms

The alarm trip delay for power failure alarm is fixed at 5 minutes.
Note that you can only receive a power failure alarm if an optional rechargeable lead acid "Gel Cell" battery is installed, since otherwise the power failure would prevent operation of the product. If you have installed an external "uninterruptible" source of 12 VDC power for the product, it will not know that there has been a failure of primary power unless this is reflected at one of the signal inputs.

5.4 Placing An Inquiry Call To The Guard-It™ Autodialer

You may call the Guard-it™ autodialer at any time other than when you are programming, to get a status report of all input channels.

The product will answer the phone after waiting for the programmed ring answer delay (default 1 ring).

The message you hear may include particular informative phrases such as "no phone numbers programmed", "power is off", "disarmed", etc. There will be two complete message rounds, followed by a listening period when the microphone is turned on, before the product ends the phone call.

If there are any unacknowledged alarms, you may acknowledged them by pressing "9" immediately following the beep.

5.5 Acknowledging An Alarm From The Front Panel

To acknowledge an alarm from the front panel, move the selector switch to the DISARMED position, then return it to the READY position. The product must not be in programming mode or presently placing a phone call, for the alarm to be acknowledged in this way.

5.6 Clearing An Acknowledged Alarm From The Front Panel

To force a clearing of the acknowledged alarm status in advance of the time when the alarm reset timer would otherwise do it, select choice [7] from the top menu, or simply turn the product off and then on again. If there is still a fault being detected, then after the expiration of the alarm trip delay, a new unacknowledged alarm will occur with new alarm calls being placed.

6 Troubleshooting & Repair Service

If the product appears "dead" with no lights or action of any kind, suspect the external power source (most likely) or a blown internal fuse (less likely). There is a diagnostic light located behind a round hole on the lower right hand edge of the enclosure. If this light is lit, it means that there is at least 8 VDC (the minimum voltage required) reaching the product and that the internal fuse (5 x 20 mm, 0.8 ampere) is good.

In turn, this means that if the light is not lit, then you can track down and correct the problem without need to return the product to the factory for service. If it is lit and the product appears dead, then factory service is needed.

Verify that all connections are correct and that the connector block is plugged firmly into place in the correct orientation.

If there is a problem with phoning, use the programming phone to test the phone line, temporarily plugging it into the premises phone line jack in place of the autodialer connection.

Most other apparent problems, especially at startup, are the result of incorrect connection or programming, or misunderstanding of how the product operates.

If after reviewing this manual you still have difficulty, Raco's Customer Support department is available from 8:00 a.m. through 4:30 p.m. P.S.T. on weekdays.

6.1 Phone Support Procedures

Make sure you have the following before you call:

- Serial #: Found on the enclosure.
- Note the unit's symptoms: Exact speech pattern, what it is saying, if it is calling or not. The more specific and accurate you are in describing the symptoms, the quicker the Customer Support Department will be able to diagnose and troubleshoot the problem. In many cases, it may save a return to the factory.

THEN call 1-800-449-4539 for Customer Support.

If Customer Support determines that the unit needs repair, you will be given a Return Materials Authorization (RMA) number.

If the product needs repair, you may send it to one of the following repair facilities often first telephoning to obtain a return authorization.

6.2 Returning Parts to Factory

Pack all parts well! Send the unit to the address below:

RACO Manufacturing and Engineering Co.
1400 62nd Street
Emeryville, CA 94608

Remember to:

- Put return address on package.
- Include a packing slip.
- Have serial # and RMA # handy when you call in for tracking.

6.3 Canada Depot Repair Summa Engineering

Pack all parts well! Send the unit to the address below:

Summa Engineering, Ltd.
6423 Northam Drive
Mississauga, Ontario
L4V 1J2 Canada

7 Testing

A suitable program of testing is highly adviseable for any alarm autodialer. The frequency and thoroughness of the test should be gauged according to the potential consequences of missing an alarm call.

Test the unit by simulating an alarm at one or more of the inputs. If you have an optional rechargeable battery installed, you can create a power failure alarm by disconnecting the external 12 VDC power source and waiting 5 minutes for a power failure alarm to be tripped.

You can leave the power disconnected and see how long the unit remains operational, running on its optional rechargeable battery. You might temporarily program an alarm reset time of, say, four hours, so that you would get a new set of calls every four hours until the battery lost charge.

8 Maintenance

The only maintenance item on the Guard-It™ autodialer is the optional rechargeable battery. It should be replaced every three years, since it will eventually fail with old age in the same way that an automobile battery does.

Replacements for this battery must be ordered near the time of changeout, since long storage on a shelf without a charger will damage the battery. It may be ordered from Raco or from the manufacturer as printed on the battery.

A ANALOG (4-20 MA) INPUTS

A.1 Connecting 4-20 MA Analog Signal Inputs

As an alternative to contact inputs or digital logic inputs, you may connect 4-20 ma analog signals to any of the inputs. The connections must be made with the correct polarity. Refer to the diagram.

Note that the negative connection points for each of the inputs are connected to each other, and to common ground, inside the product. Most 4-20 ma signal circuits are "floating" with respect to ground, and for such signal circuits the grounded inputs on the Guard-It™ autodialer will usually cause no problems.

However some 4-20 ma signal circuits already have a connection to ground at some other point in the current loop. If your current loop has such a connection and if you cannot remove it, it is best to install an "isolator" such as Model T700-0000 made by Action Instruments (619) 279 5726 . Otherwise, signal errors will be introduced, both for the Guard-It™ autodialer and for any other elements in the same current loop.

Note that similar devices are available from the same manufacturers, which accept signals in different formats (such as 0-1 VDC, etc.) and which translate such signals into standard 4-20 ma signals which the Guard-It™ autodialer can accept.

The easiest way to verify that there are no grounding problems, is to verify that the current in the loop does not change when the Guard-It™ autodialer is added to the loop.

For example, if there is a chart recorder or readout device in the current loop, first take a reading with the Guard-It™ autodialer completely disconnected from the loop.

Do this by unplugging the connector block and temporarily shorting the + and - inputs on the signal input points on this connector block. Observe the reading, and then remove the short and plug in the connector block to include the Guard-It™ autodialer in the loop, turn it on, and verify that this does not change the reading on the readout device. All power and ground connections to the Guard-It™ autodialer must be in place for this test to be valid. Also, the input channel being tested must be programmed for analog input as described below.

If you are troubleshooting by making voltage measurements across the signal input connection points on the Guard-It™ autodialer, bear in mind that if the product is turned off or if it has not been programmed for analog input, an internal voltage clamp will result in a fixed voltage drop of about 7 VDC. If the product is turned on and the input has been programmed for analog input, a loop resistance of about 220 ohms will result in a voltage drop of approximately 0.88 VDC with a signal level of 4 ma, and approximately 4.4 VDC with a signal level of 20 ma.

A.2 Programming For Analog Signal Inputs

From the top menu, when you select [1] for input programming and then select an input channel number to program, the voice menu will prompt you with the following choices:

[1] Alarm on Open Circuit

[2] Alarm on Closed Circuit

[3] Off (so that this input channel will not report or activate its corresponding front panel LED)

[4] Analog (4-20 ma current loop) signal.

If an input channel is configured for an analog signal, the menu also gives you two additional choices:

[5] To program an analog high alarm level set point value

[6] To program an analog low alarm level set point value

Example: to program input channel number four for analog input, from the top menu you would press [1] for input programming, then [4] to select input number four, then [4] again to configure this input channel for analog input.

Input channels which have been programmed for analog (4-20 ma) signals, will report a 4 ma signal level as 0.0% and a 20 ma signal level as 100.0%. Signal levels between these limits will be reported in linear scale proportion as a percentage between 0.0% and 100.0 %. Note that as a result of this linear analog scale, an input current of 0 ma would give a reading of *minus* 25.0%.

The Guard-It™ autodialer is very sensitive, being capable of detecting variations as little as 0.1%. Absolute accuracy should be within 0.5%. Due to substantial input filtering, it takes several seconds for any sudden change in input level to become fully settled.

A translation table appears below, relating the analog input signal in milliamperes to the spoken percentage reading. It also allows you to write in the corresponding actual physical readings (such as water level in feet, etc.) for various signal levels.

When programming analog high or low alarm set points, enter the set points as a percentage value, using the star (*) key for a decimal point if desired.

EXAMPLE: to enter a high set point value of 56.8% for input channel number 4, from the top menu you would press [1] for input programming, then [4] to select input number four, then [5] to select the high alarm set point for this input channel, and then:

5 6 * 8 #.

The menu will allow you to program high or low analog set points only if the input channel has first been programmed for analog input.

To turn off a given alarm set point so that it will not create an alarm, press "star" (*) and then pound (#).

In operation, whenever a high or low level alarm setpoint is exceeded continuously for the duration of the programmed alarm trip delay, an unacknowledged alarm will occur.

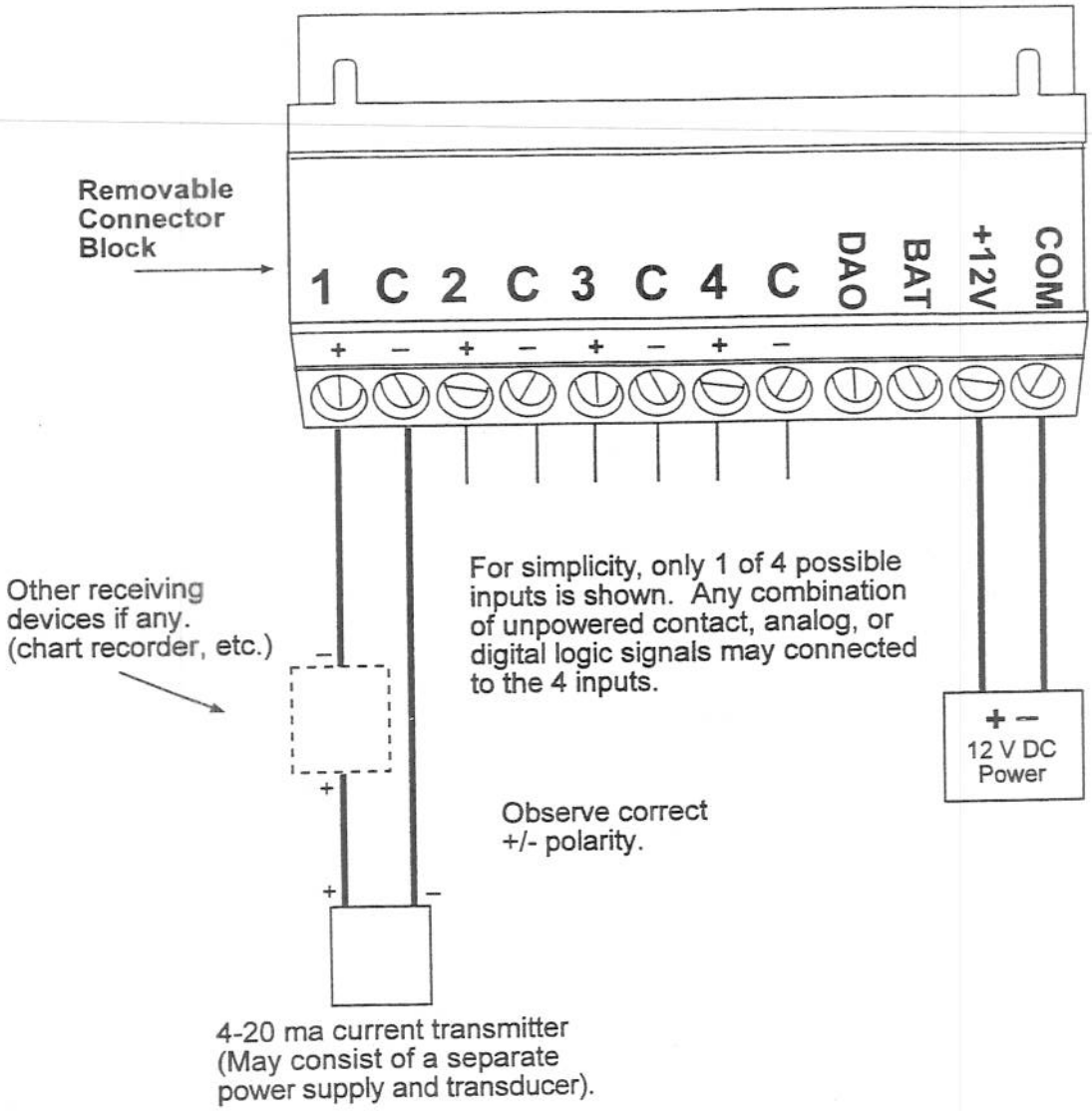
A.3 Analog Translation Table

This table translates various input signal levels in milliamperes, to the corresponding percentage values which will be reported.

It also allows you to write in the corresponding translation to the actual physical parameter being measured, such as water level in feet, etc. You can make copies of this for later use, even including reference to this table in your recorded message, which might be: "Referring to the analog translation table, the water level percentage reading is."

SIGNAL LEVEL:	SPOKEN READING:	CORRESPONDS TO PHYSICAL VALUE ON INPUT CHANNEL NUMBER (Description)			
		1(_____)	2(_____)	3(_____)	4(_____)
4.0 Millamperes	0%				
4.8 Millamperes	5%				
5.6 Millamperes	10%				
6.4 Millamperes	15%				
7.2 Millamperes	20%				
8.0 Millamperes	25%				
8.8 Millamperes	30%				
9.6 Millamperes	35%				
10.4 Millamperes	40%				
11.2 Millamperes	45%				
12.0 Millamperes	50%				
12.8 Millamperes	55%				
13.6 Millamperes	60%				
14.4 Millamperes	65%				
15.2 Millamperes	70%				
16.0 Millamperes	75%				
16.8 Millamperes	80%				
17.6 Millamperes	85%				
18.4 Millamperes	90%				
19.2 Millamperes	95%				
20.0 Millamperes	100%				

Analog 4-20 ma Signal Input Wiring Connection Diagram



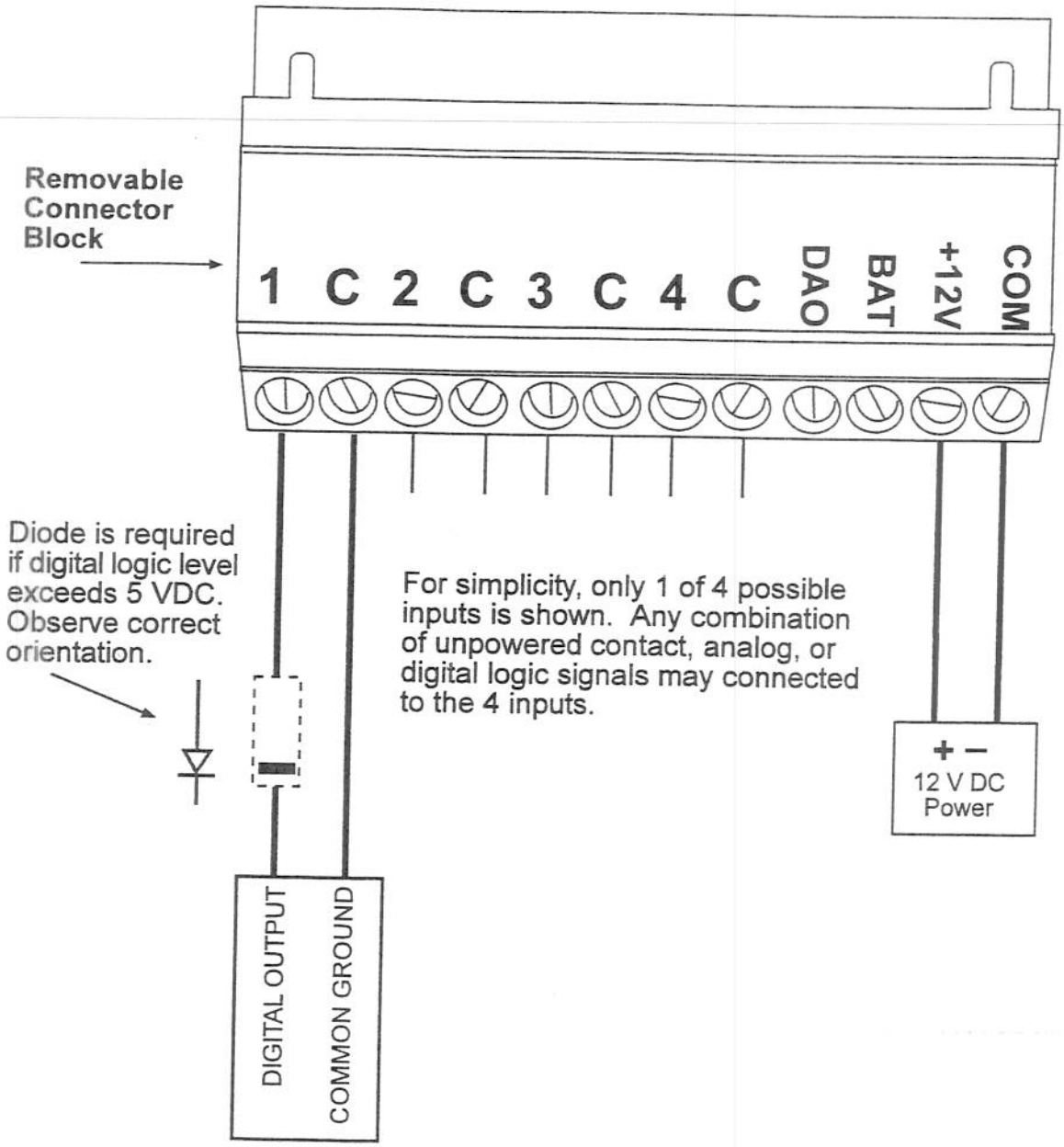
B CONNECTING DIGITAL LOGIC SIGNAL INPUTS

As an alternative to contact inputs, you may connect 5-volt logic signals as long as the common electrical ground for the Guard-It™ autodialer is the same as for the 5 volt logic system.

A logic "0" will be interpreted by the Guard-It™ autodialer as a closed circuit, and a logic "1" will be interpreted as an open circuit.

If you want to connect higher voltage logic signals (up to 24 VDC), insert a rectifier diode (such as a 1N914, 1N4005, etc.) between the logic signal and the signal input on the Guard-It™ autodialer. *The diode must be oriented so that the cathode (banded) end is connected to the logic signal.*

Digital Logic Signal Input Wiring Connection Diagram



C DIGITAL ALARM OUTPUT (DAO)

The digital alarm output may be used to activate an external device such as the coil of a relay or the input of a logic circuit.

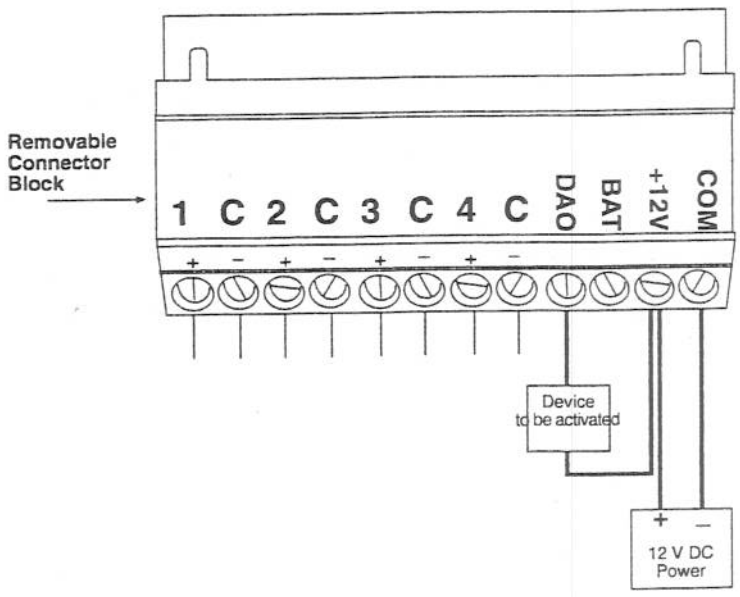
This output is activated (pulled down to common ground voltage) whenever there is an unacknowledged alarm. It is deactivated when the alarm is acknowledged.

The load you connect will have 12 VDC applied across it when activated, if you connect as shown in the diagram. It must draw no more than 200 milliamperes, and so it must have a resistance of at least 60 ohms.

A typical application would be to power the coil of a relay. The contacts of the relay may then be used to control devices of higher voltage and power, such as outside warning lights or buzzers.

Alternatively, the DAO output may be connected directly into a DC logic input circuit. It has an internal 10k resistor pulling it to +5VDC when deactivated, and it is pulled to ground when activated. It may even be connected into a 24 VDC logic input such as found on PLC's, but due to the resistor connected to +5VDC, an external pullup resistor (nominally 1K) to a +24 VDC source may be needed.

Optional Digital Alarm Output (DAO) Connection Diagram



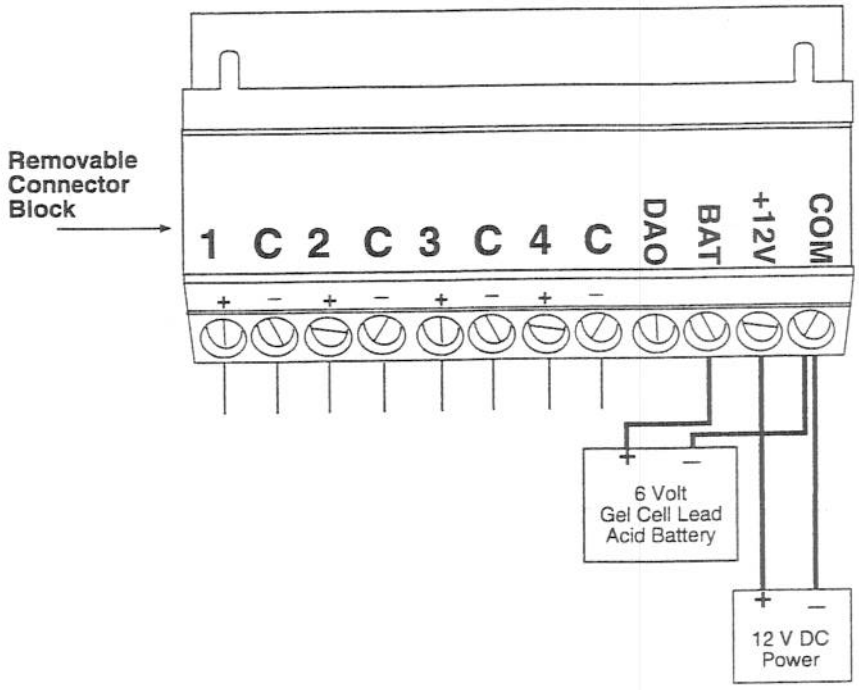
D

OPTIONAL EXTERNAL GEL CELL BACKUP BATTERY

An internal 6 volt, 4 ampere-hour battery is an available option for the Guard-It™ autodialer. However as an alternative or in addition to the optional internal battery, you may connect your own 6 volt gel cell lead acid battery as shown in the diagram. It may have a capacity of up to 10 ampere hours. The battery will be kept charged by the product's internal circuitry.

The function of any such battery is to maintain operation of the product during failures of primary power. Each ampere hour of capacity will keep the product operational for approximately 6 hours depending on the number of alarm calls placed and other factors.

Optional External Battery Connection Diagram



E PROGRAMMING FOR USE WITH NUMERIC PAGERS

Numeric pager systems require the caller to dial the phone number of the pager service, wait for a prompting beep, and then enter some additional digits which are to be displayed on the receiving pager, and then finally, enter a pound(#) to complete the entry.

To call and cause a display on a numeric pager, your Guard-It™ autodialer will do essentially the same thing, except that it will wait for a delay period which you set, instead of listening for the pager system's beep, before sending the remaining digits.

This is all accomplished by programming an "extended" phone number, which includes a delay which you invoke by pressing the star (*) key.

To program this special "extended" phone number, after selecting which of the 8 phone numbers to program, key in the telephone number of the paging service, then press the star (*) key, then continue with the digits that you want to appear on the receiving pager, and finally press pound (#) when your entry is complete, then wait three seconds for the Guard-It™ autodialer to automatically accept and repeat back the extended phone number which you have entered.

In this special case after you have invoked a dialing delay by using the star (*) key, the Guard-It™ autodialer treats the pound (#) key in a special way. Normally, the pound (#) key is used to accept an entry or to return to a previous menu level. However once a delay has been invoked, *the star and pound keys are treated as "dialable" digit values for the remainder of this programmed phone number*. This allows for the desired result of including a # which will actually be "dialed" to complete the communication with the pager system.

For example, to display "12345" on a pager which can be "paged" by calling 555 1000, you would key in:

5 5 5 1 0 0 0 * 1 2 3 4 5 #

and then wait three seconds for the Guard-It™ autodialer to accept and recite back this extended phone number, which it will recite as:

5 5 5 1 0 0 0 "Delay 1 0 seconds" 1 2 3 4 5 "Pound".

(The stated number of delay seconds will be whatever Dialing Delay value is programmed—see below).

In a typical application, the Guard-It™ autodialer's own phone number would be the number to be programmed for display.

The other step you must take, is to place several calls to the pager system in order to determine by experiment how long a waiting time is suitable before the paging system will reliably have issued its prompting beep, so that it is definitely ready to accept the digits to be displayed. Begin the timing at the moment you dial the last digit of the pager service number, and end the timing when you hear the pager service's prompting beep. We suggest you add three seconds to the longest time period you observe. Use a regular telephone to place the calls.

Then program this delay value in seconds, as the Dialing Delay under the General Programming Menu. The default value is ten seconds, and this value will work for many pager systems without alteration.

With the extended phone number and Dialing Delay value fully programmed, it is best to verify (three times is suggested) that the Guard-It™ autodialer will successfully cause the pager to be reached with the intended display.

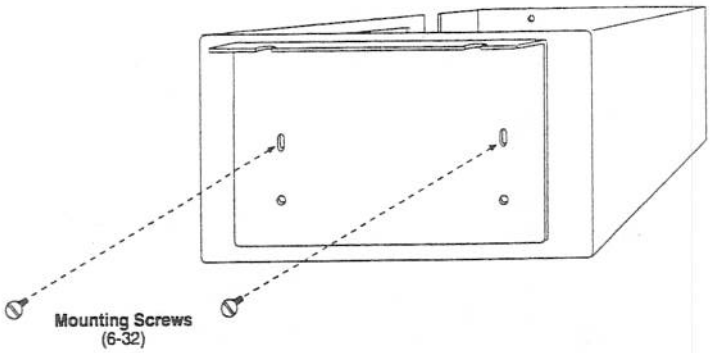
This is done by manipulating one of the signal inputs to cause an alarm.

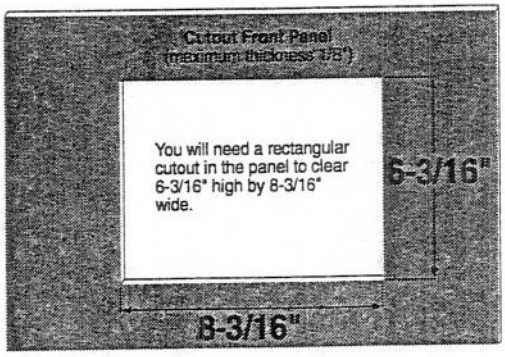
Note: Because pager systems issue a variety of special signaling tones, it is best to keep the Call Progress feature turned off if using pager systems.

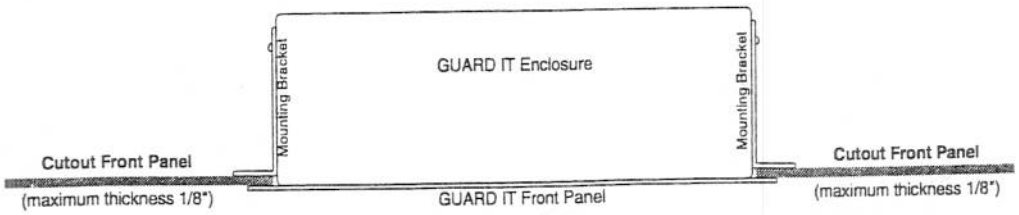
You can "eavesdrop" on the progress of the test calls using a programming phone, as long as Call Progress is turned off. Do not pick up the programming phone until the dialing begins.

F ENCLOSURE MECHANICALS & WIRING DIAGRAMS

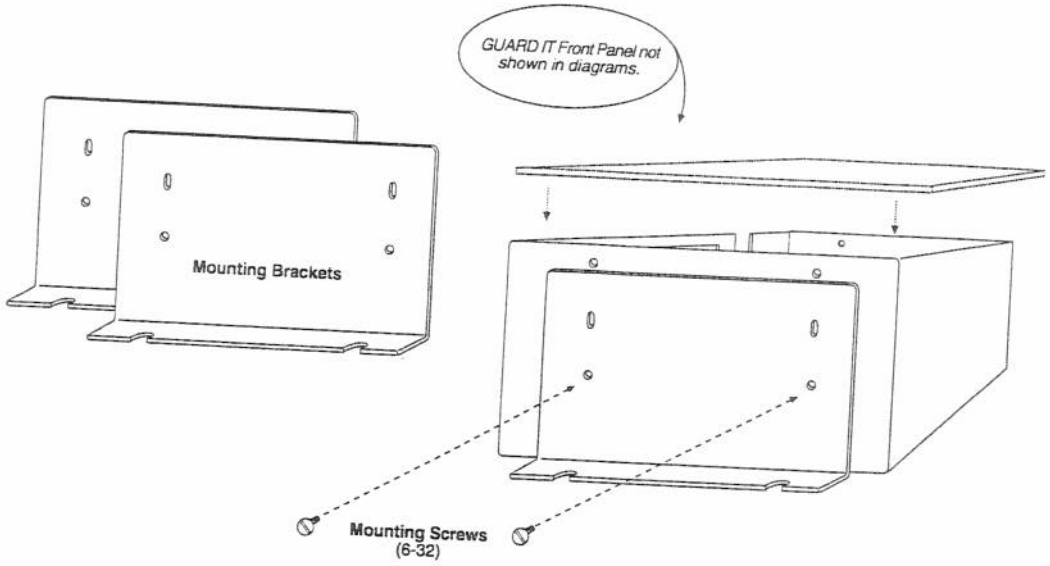
Mounting the Guard-It™ Autodialer Enclosure Flush into a Front Panel

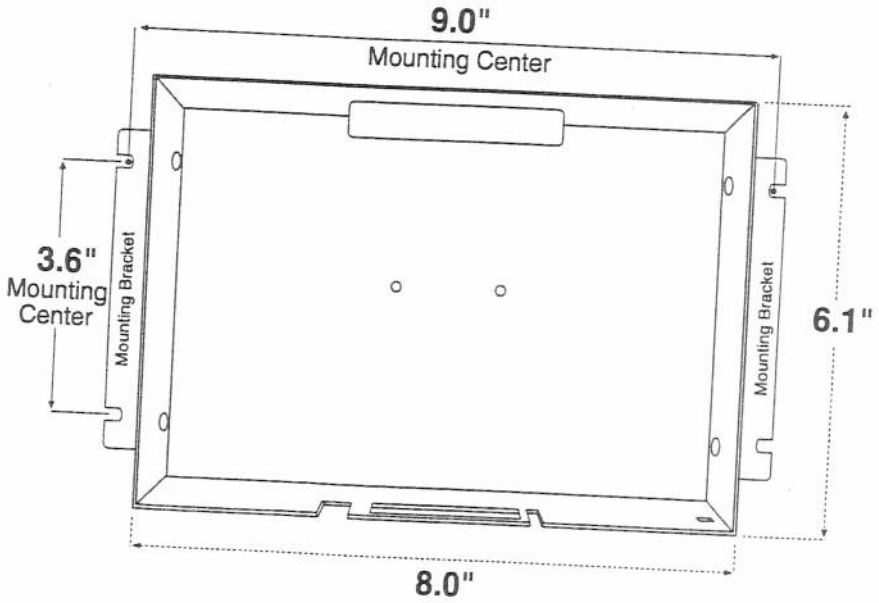




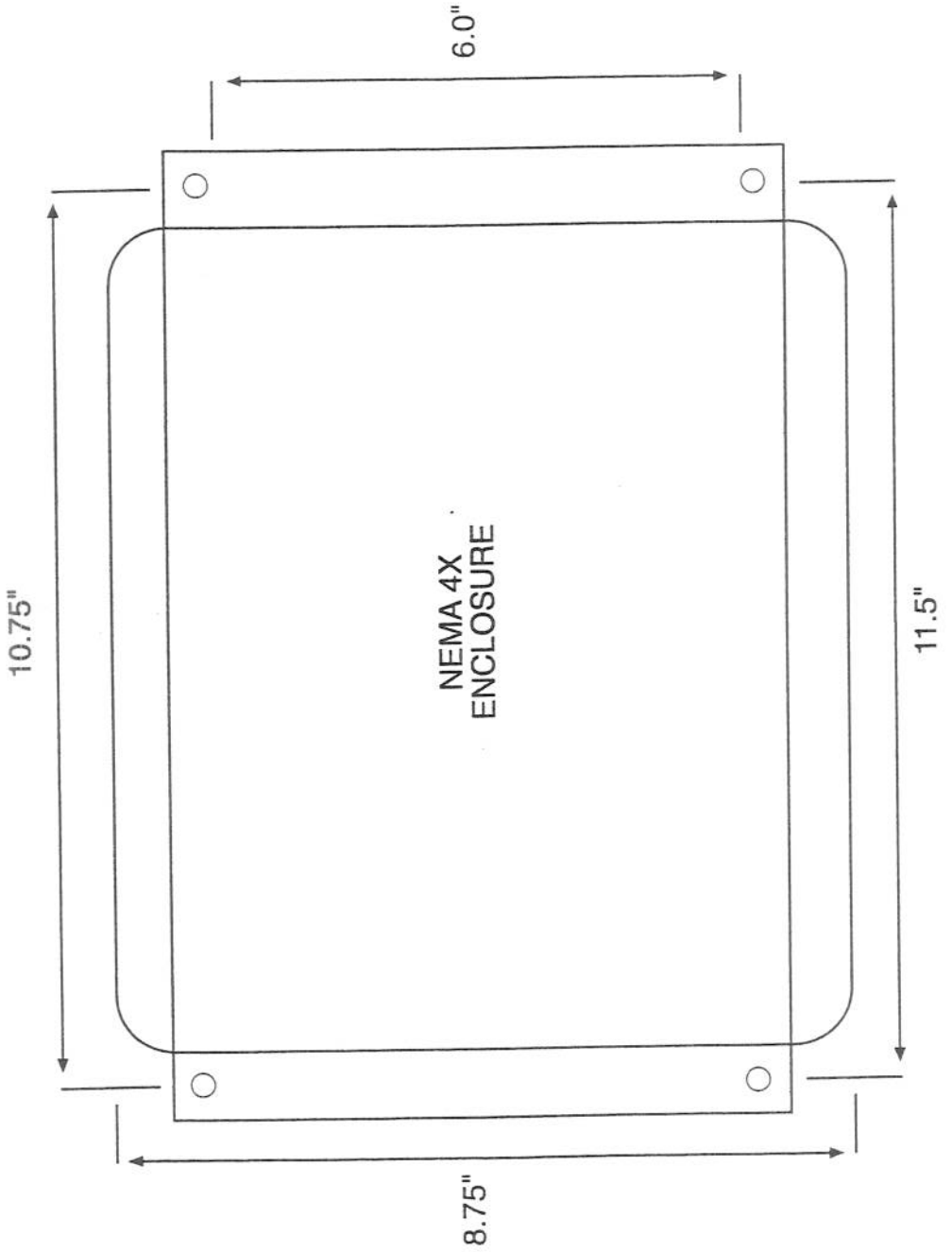


Mounting the Guard-It™ Autodialer Enclosure onto a Back Surface





Guard-It™ NEMA4X Enclosure



WARRANTY REGISTRATION

If you complete and mail in this warranty registration form within 30 days of purchase we will send you a ***FREE GIFT*** in appreciation of your prompt response. Postage is paid if mailed in the U.S. otherwise, please return to the address shown on the back of this card.

Model: _____ Guard-It G02785

Serial Number: _____

Name: _____

Title: _____

Company: _____

Department: _____

Address: _____

City: _____

State: _____ Zip: _____

Country: _____

Phone: _____

Fax: _____

E-Mail address: _____

All warranty information can be found in your owners manual. If you would like information on any of our autodialer systems, i.e., product brochure, specifications, options, drawings or technical support, we have a fully automated **Fax-On-Demand System**. Simply call **(510) 658-6716, Ext. 6**, either from your touch tone telephone or your fax machine, and follow the voice instructions. Request our *Catalogue of Documents – Document No. 100* and receive a complete catalog of all available documents.

The following information will assist us in our continuing efforts to provide you with products that meet your specific requirements.

1. The autodialer is used for:
   - ☐ Waste Water
   - ☐ Gas Pipeline
   - ☐ Remote Equipment
   - ☐ Cold Storage
   - ☐ Chemical Manufacture
   - ☐ Energy Generation
   - ☐ Agriculture
   - ☐ Other_____

2. Types of transducer used:
   - ☐ Pressure
   - ☐ Temperature
   - ☐ Flow
   - ☐ Electrical Detection
   - ☐ Gas (All Types)
   - ☐ Intrusion
   - ☐ Float Level
   - ☐ Other_____

3. I became aware of your products from:
   - ☐ Dealer Showroom
   - ☐ Trade Show
   - ☐ Colleague
   - ☐ Professional Association
   - ☐ Magazine
   - ☐ Mailer
   - ☐ Other_____

4. I read the following publication(s):
   - ☐ *Water & Wastes Digest*
   - ☐ *Waterworld News*
   - ☐ *Pollution & Equipment News*
   - ☐ *Pollution Engineering*
   - ☐ *W.E.F. Journal*
   - ☐ *AWWA Journal*
   - ☐ Other(s)_____

5. ***FREE GIFT*** (Choose one item only): ☐ Flashlight ☐ Engraved Pen ☐ Multi-function Knife

SINCE 1948
RACO®
REMOTE ALARMS AND CONTROLS

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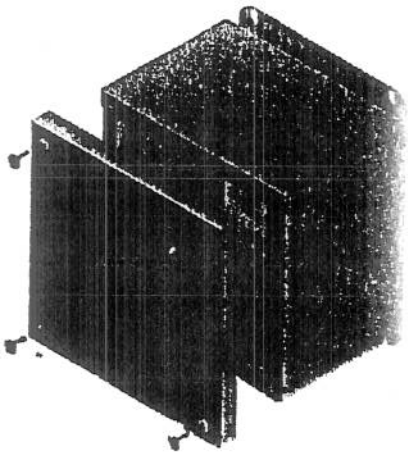
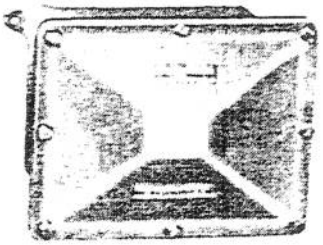
WEATHERPROOF ENCLOSURES NEMA 3R

- GASKETED LIFT OFF COVER
- NO BACKPAN
- WALL MOUNTING EARS TOP AND BOTTOM
- GALVANIZED STEEL
- ASA-61 GREY POWDER COATED FINISH

	Description
WP 664	6 X 6 X 4
	8X 8 X 4
WP 886	8X 8 X 6
	10 X 10 X 4
WP 10106	10 X 10 X 6
	12 X 12 X 4
WP 12126	12 X 12 X 6
	16 X 16 X 6
WP 18186	18 X 18 X 6
	24 X 24 X 6



- ALSO AVAILABLE IN ALUMINUM AND STAINLESS STEEL – CONSULT FACTORY
- CONSULT FACTORY FOR CUSTOM SIZES



Application:

WJB boxes are standard with mounting feet and are primarily designed for surface mounting, but may be ordered less mounting feet for flush mounting. WJB heavy duty junction boxes are installed in conduit systems to:

- act as pull box for conductors.
- provide openings and space for making splices and taps in conductors.
- provide for branch conduit runs.
- provide access to conductors for maintenance and future system changes.
- enclose and protect electrical equipment.

Standard Materials:

- *Feraloy®* iron alloy – cover and body
- Neoprene gaskets

Standard Finishes:

- *Feraloy®* iron alloy – hot dip galvanize

Approx. Wall Thickness	Cat. #
1/4	WJB040404
1/4	WJB060404
1/4	WJB080604
1/4	WJB080606
1/4	WJB080804
1/4	WJB080806
1/4	WJB100804
1/4	WJB100806
1/4	WJB100808
1/4	WJB120804
1/4	WJB120806
1/4	WJB120808
5/16	WJB181206
5/16	WJB181208
5/16	WJB181210
5/16	WJB181212
3/8	WJB241206
3/8	WJB241208
3/8	WJB241210
3/8	WJB241212
3/8	WJB241806
3/8	WJB241808
3/8	WJB241810
3/8	WJB241812
9/16	WJB242406
9/16	WJB242408
9/16	WJB242410
9/16	WJB242412

THE GOVERNMENT OF NUNAVUT
PUBLIC WORKS AND SERVICES

PROJECT: WATER SUPPLY PIPELINE REPLACEMENT
LOCATION: CAPE DORSET, NUNAVUT
PROJECT NO: 4-002-473

LOCATION PLAN

LIST OF DRAWINGS

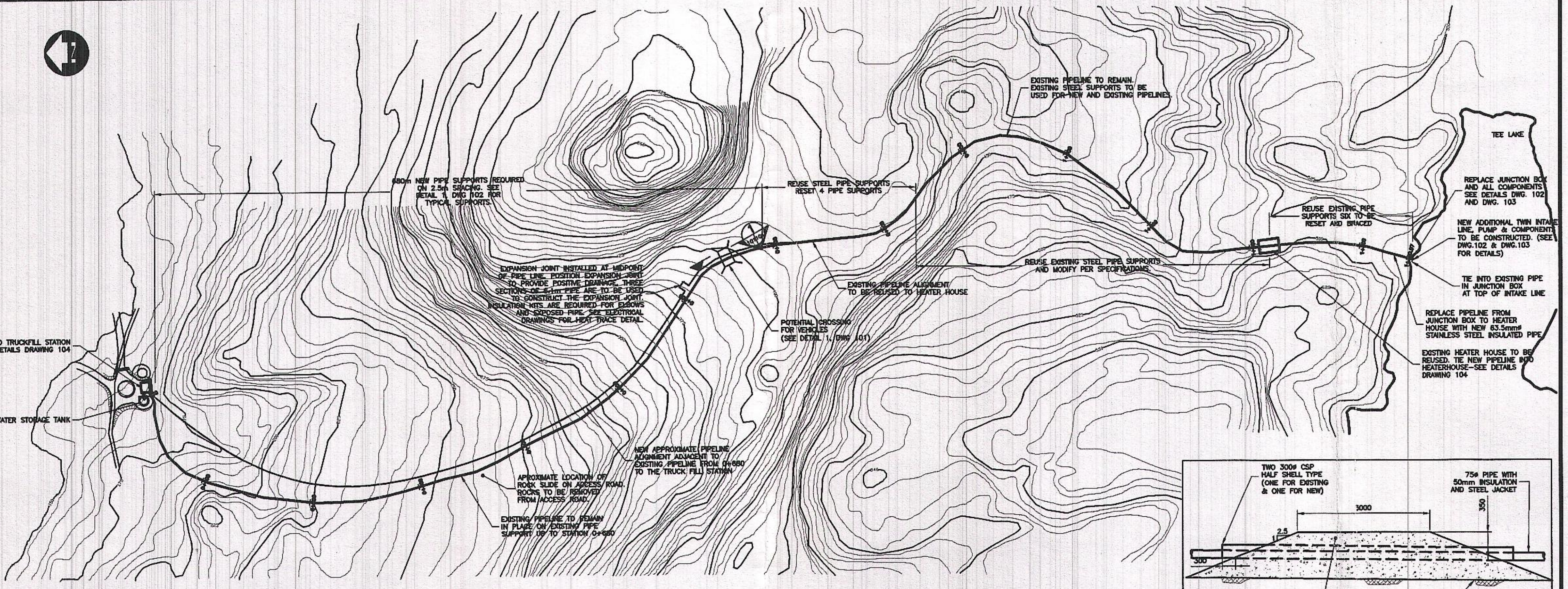
000 COVER SHEET
101 PIPELINE REPLACEMENT – PLAN AND PROFILE
102 FLOW DIAGRAM AND INTAKE SYSTEM
103 INTAKE AND JUNCTION BOX DETAILS
104 ELECTRICAL AND MISCELLANEOUS DETAILS
105 ELECTRICAL DETAILS
106 ELECTRICAL PANEL AND CONTROL SCHEMATICS
⚠107 ELECTRICAL CONTROLS

NOT TO SCALE
REDUCED FROM RECORD DRAWING

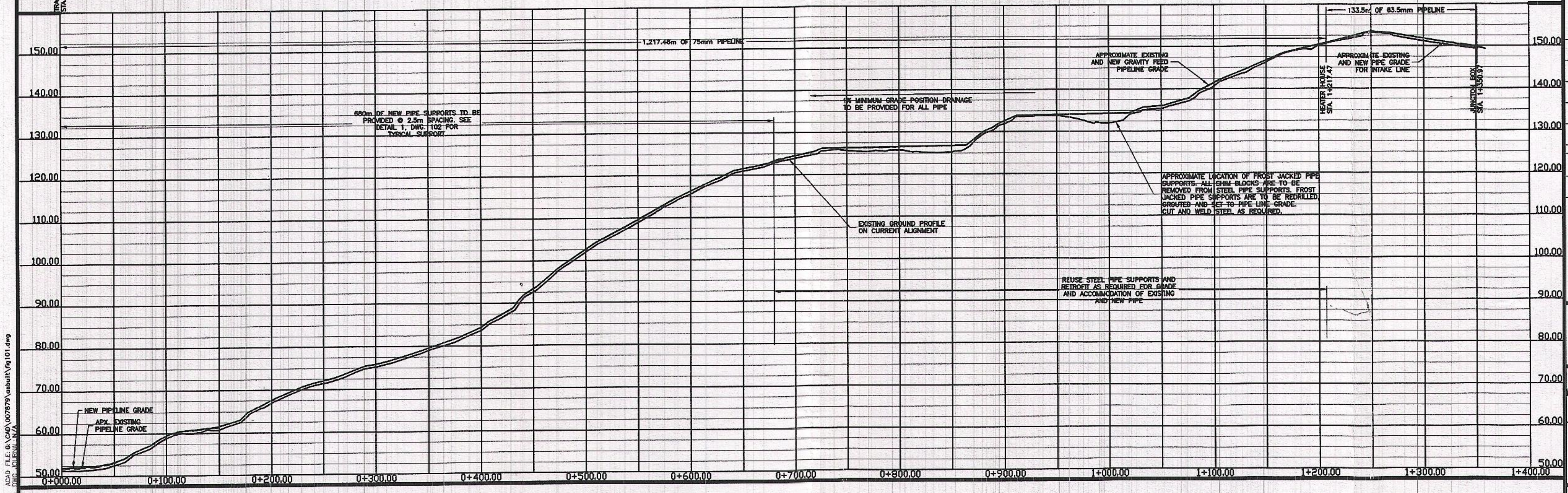
DILLON CONSULTING

DRAWING NUMBER 000

EDIT DATE: 12/02/02 ACAD FILE: G:\CAD\007579\asbuilt\cover.dwg
BASE NAME: d_dpw.dwg DWG JOURNAL: N/A



TYPICAL VEHICLE CROSSING
SCALE 1:50



NOTES:

LOCATION OF STRUCTURES AND COMPONENTS ARE BASED IN PART BY INFORMATION PROVIDED BY OTHERS. NO GUARANTEE IS GIVEN THAT ALL STRUCTURES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND LOCATION OF ALL ITEMS MUST BE CONFIRMED BY THE CONTRACTOR.

CONTOUR ELEVATIONS ARE INDICATED IN FEET.

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RECORD DRAWING

APPROVED BY ______ DATE ______

NOT TO SCALE
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CHANGE	DATE	DESCRIPTION	CHECK
4	DEC/02	RECORD DRAWING	GS
3	APR/01	ISSUED FOR TENDER	KAG
2	MAR/01	100% REVIEW	KAG
1	JAN/01	80% REVIEW	KAG
0	AUG/00	ISSUED FOR REVIEW	KAG

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
GS	SCD/DHF	KAG	DEC 02

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PERMIT NUMBER P 000
M. M. DILLON LIMITED

REGISTERED PROFESSIONAL ENGINEER K.A. GUENTHER NWT.

DILLON CONSULTING

Nunavut

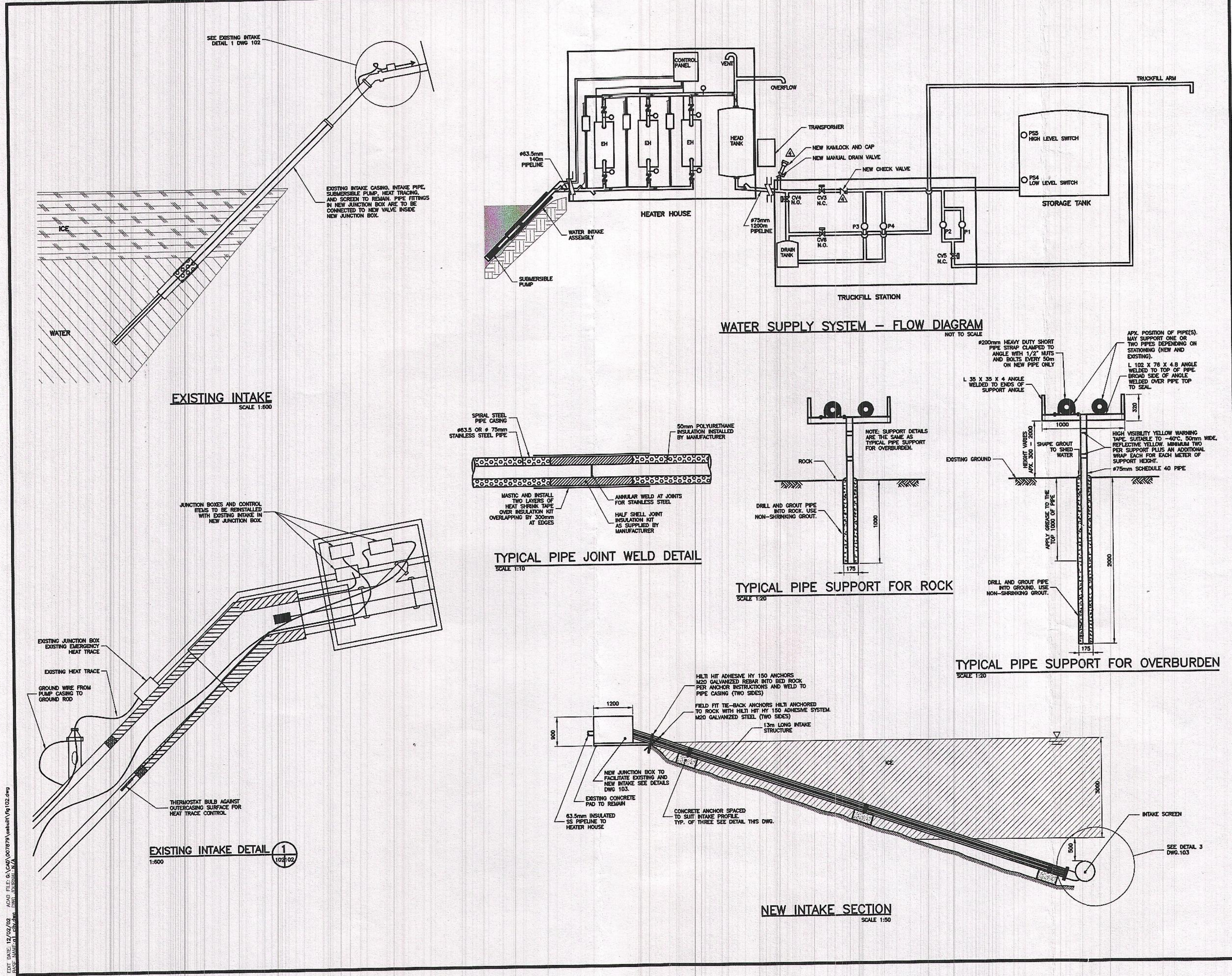
PROJECT
WATER SUPPLY PIPELINE REPLACEMENT
CAPE DORSET, NUNAVUT

TITLE
PIPELINE REPLACEMENT
PLAN AND PROFILE

SCALE
SCALE: HOR=1:2000 VER=1:500

PROJECT NUMBER
007879

DRAWING NUMBER
101



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CHANGE	DATE	DESCRIPTION	CHECK
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3	APR/01	TENDER ISSUE	KAG
2	MAR/01	100% REVIEW	KAG
1	JAN/01	80% REVIEW	KAG
0	AUG/00	ISSUED FOR REVIEW	KAG

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
KAG	SCD/DHF	GS	DEC 02

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PERMIT NUMBER P 010
M. M. DILLON LIMITED

REGISTERED PROFESSIONAL ENGINEER K. A. GUENTHER N.W.T.

DILLON CONSULTING

Nunavut

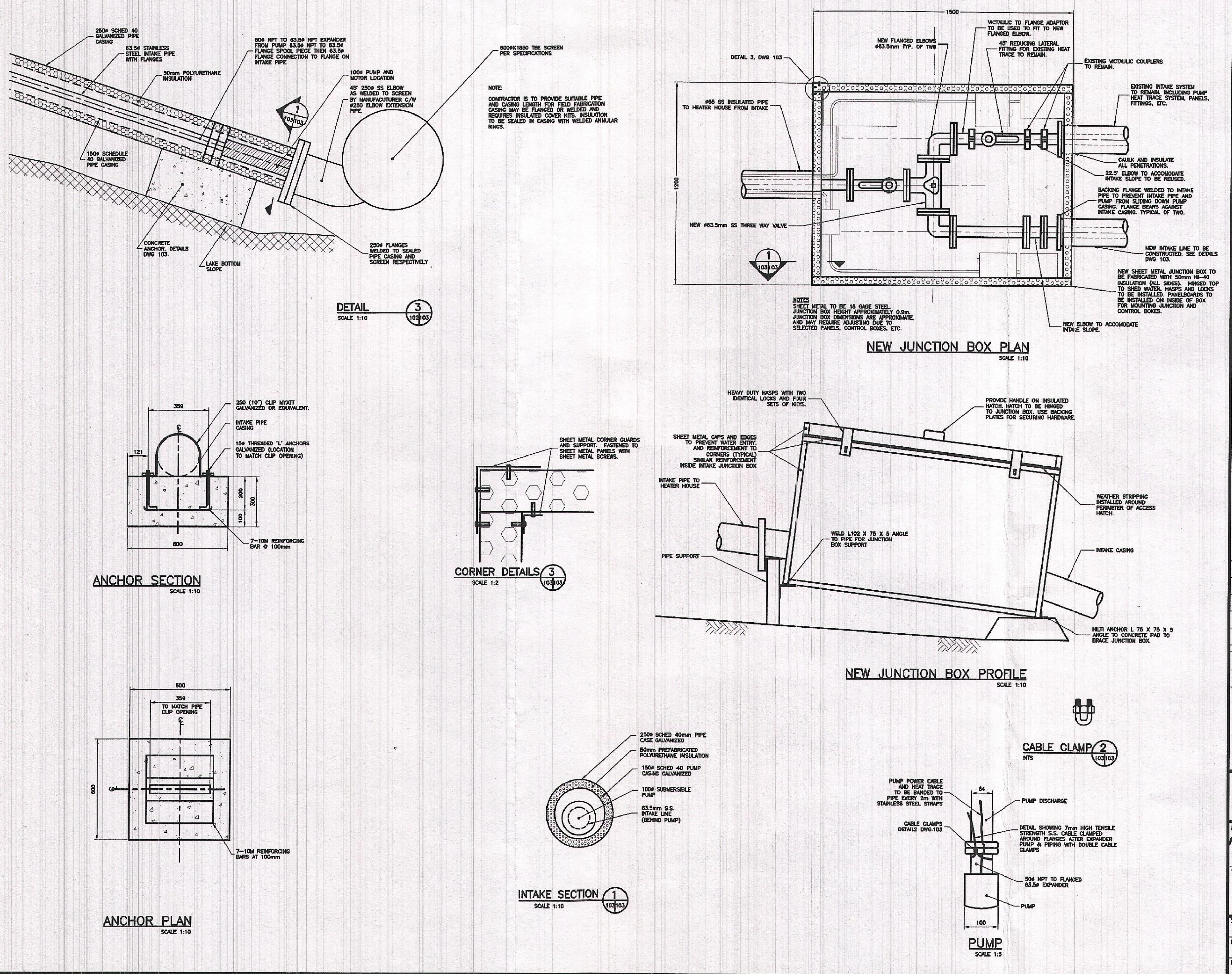
PROJECT
WATER SUPPLY PIPELINE REPLACEMENT
CAPE DORSET, NUNAVUT

TITLE
FLOW DIAGRAM AND INTAKE SYSTEM

SCALE: AS SHOWN

PROJECT NUMBER: 007879

DRAWING NUMBER: 102



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RECORD DRAWING

APPROVED BY　　　DATE

NOT TO SCALE

REDUCED FROM RECORD DRAWING

CHANGE	DATE	DESCRIPTION	CHECK
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1	JAN/01	80% REVIEW	KAG
0	AUG/00	ISSUED FOR REVIEW	KAG

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
KAG	SCD/DHF	GS	DEC 02

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Nunavut

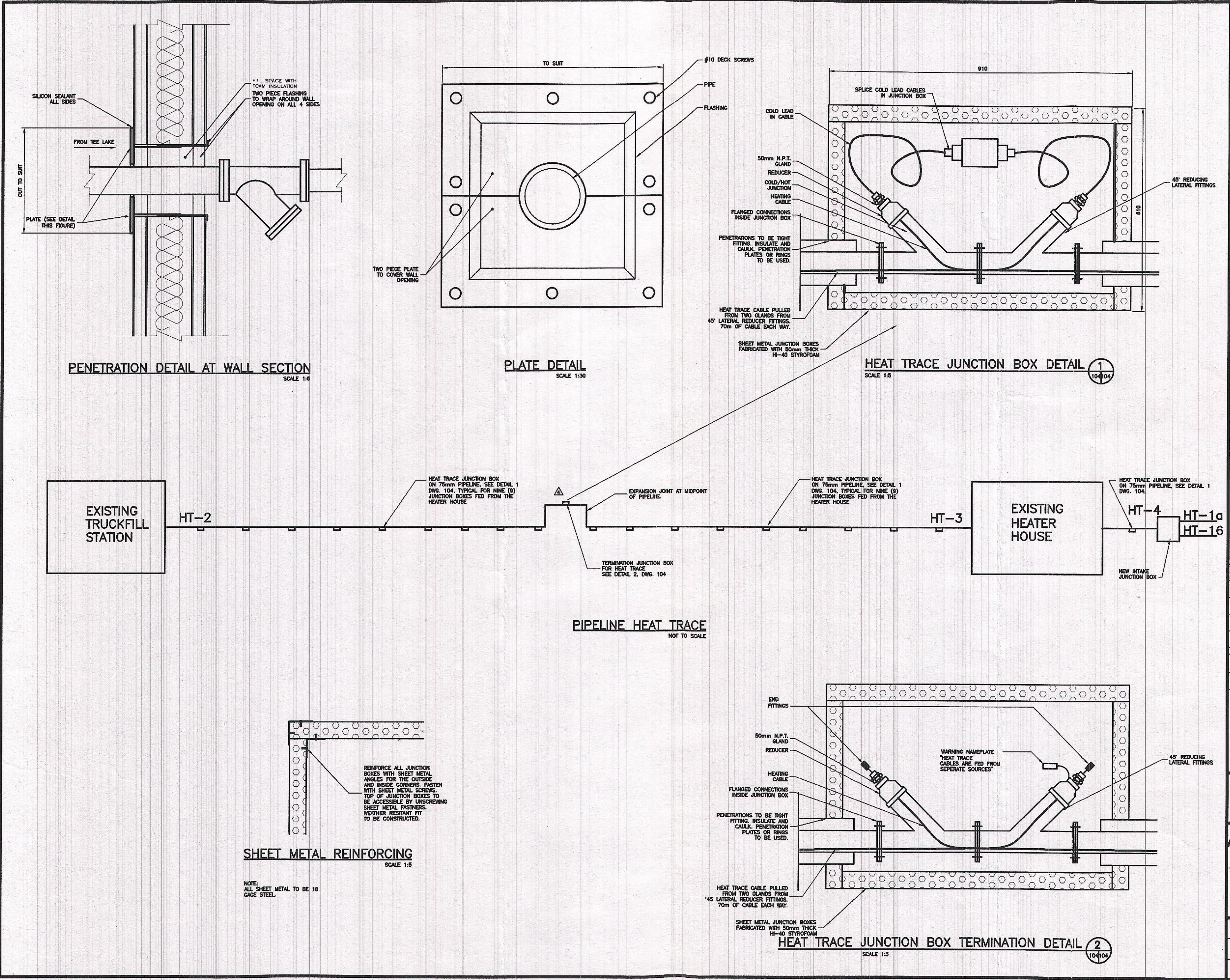
PROJECT
WATER SUPPLY PIPELINE REPLACEMENT
CAPE DORSET, NUNAVUT

TITLE
INTAKE AND JUNCTION BOX DETAILS

SCALE
AS SHOWN

PROJECT NUMBER
007879

DRAWING NUMBER
103



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RECORD DRAWING

APPROVED BY DATE

NOT TO SCALE
REDUCED FROM RECORD DRAWING

CHANGE	DATE	DESCRIPTION	CHECK
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2	JAN/01	100% REVIEW	KAG
1	JAN/01	80% REVIEW	KAG
0	AUG/00	ISSUED FOR REVIEW	KAG

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
AN	SCD	KAG	DEC 02

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PERMIT NUMBER
M. M. DILLON LIMITED

DILLON CONSULTING

Nunavut

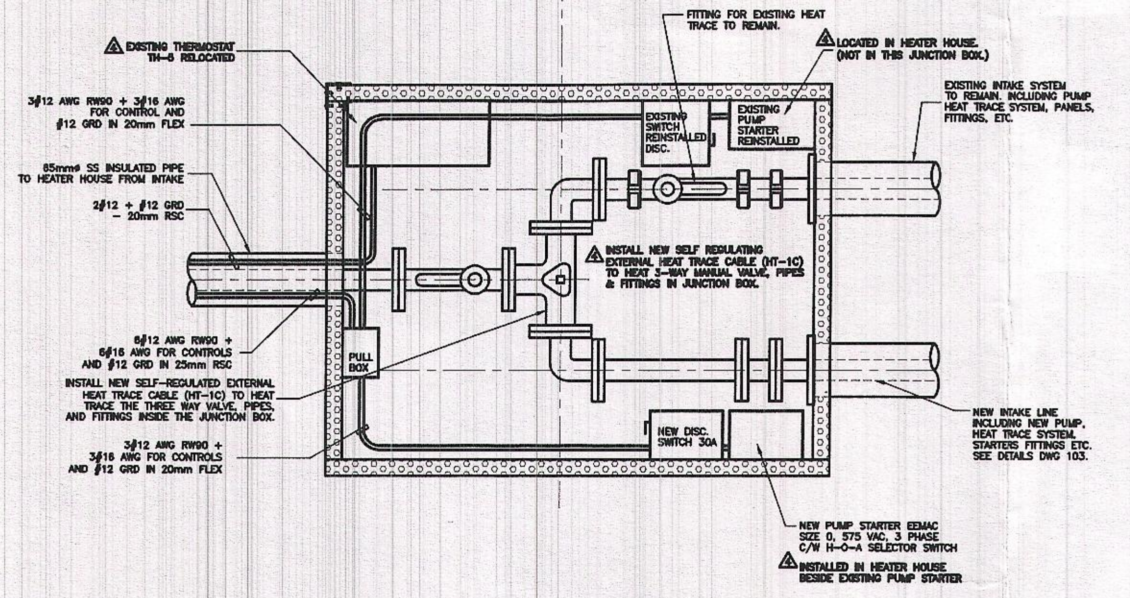
PROJECT
WATER SUPPLY PIPELINE REPLACEMENT
CAPE DORSET, NUNAVUT

TITLE
ELECTRICAL AND MISCELLANEOUS DETAILS

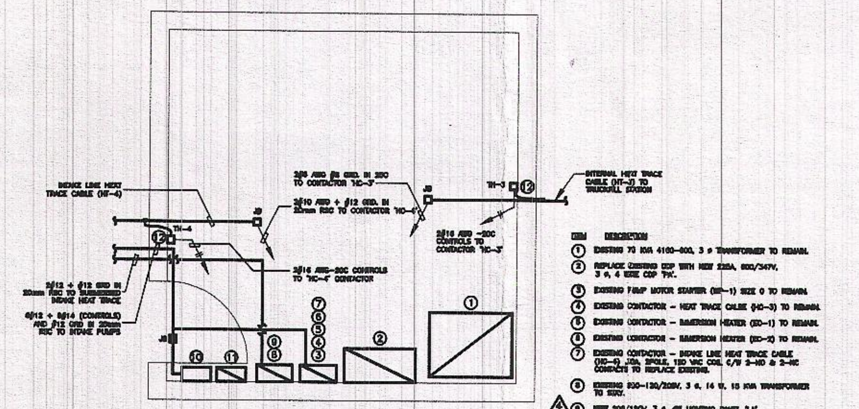
SCALE: AS SHOWN

PROJECT NUMBER: 007879

DRAWING NUMBER: 104

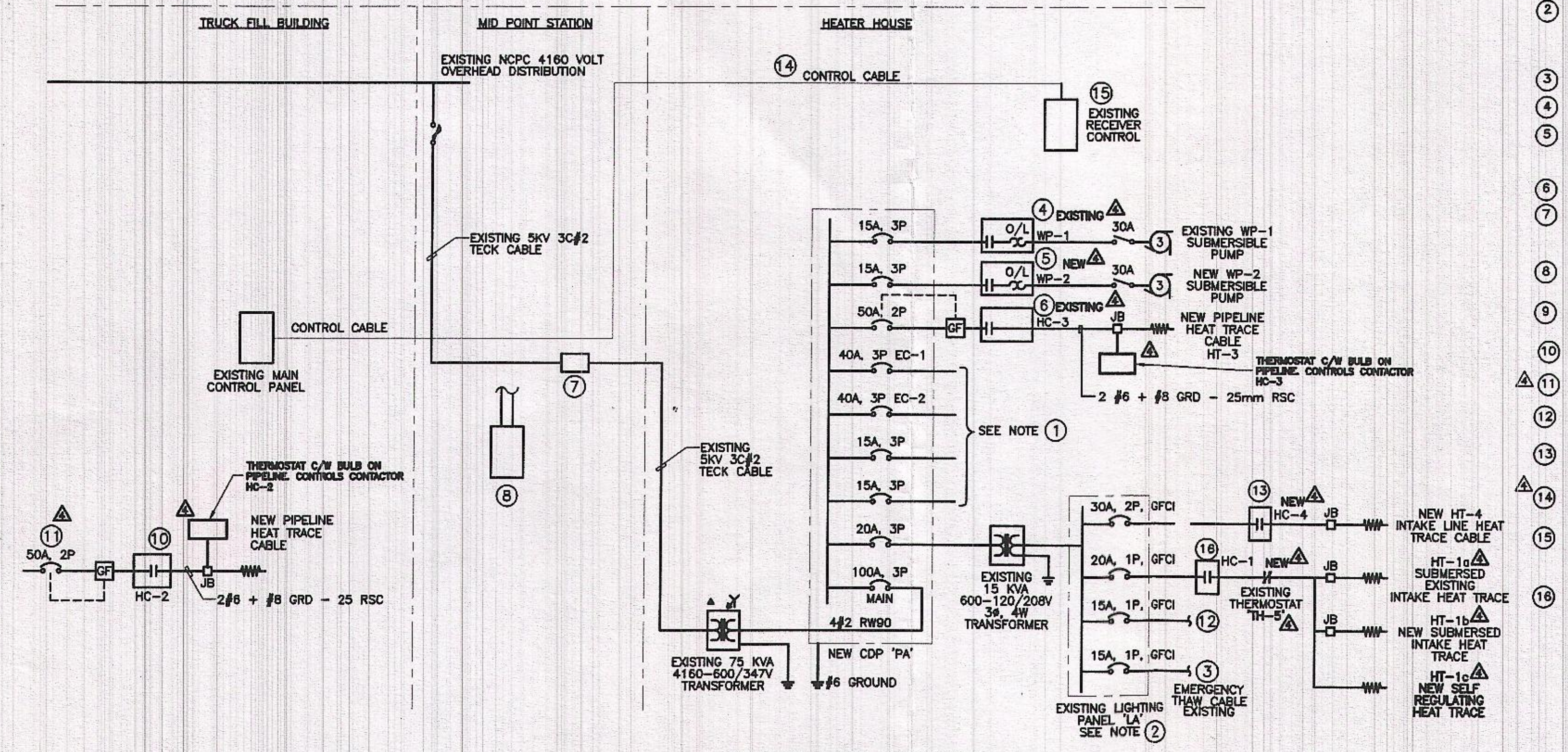


NEW JUNCTION BOX DETAILS
SCALE 1:10



HEATER HOUSE
N.T.S.

HT-1 P1, P2, AND SELF REGULATING HEAT TRACE
HT-2 LOWER PIPELINE HEAT TRACE
HT-3 UPPER PIPELINE HEAT TRACE
HT-4 TEE LAKE TO PUMP HOUSE
H.T. OVERFLOW HEAT TRACE
H.T. EMERGENCY THAW CABLE



SINGLE LINE DIAGRAM
N.T.S.

KEYNOTE

1. RECONNECT ALL EXISTING CIRCUITS FOR IMMERSION HEATERS, UNIT HEATERS TO NEW CDP.
2. EXISTING 225A, 208/120V, 3 PH, 4 W, LIGHTING PANEL 'LA'. INSTALL NEW GFCI (30 mA) BREAKERS C/W ALARM CONTACTS, FOR HEAT TRACE CABLES IN THE SPACES PROVIDED.
3. RECONNECT THAW CABLE TO NEW GFCI BREAKER.
4. EXISTING MOTOR STARTER 'WP-1' TO BE REUSED.
5. NEW MOTOR STARTER 'WP-2', SIZE 0, EEMAC 1 ENCLOSURE C/W OVERLOAD, 2NC AND 2NO AUX. CONTACTS, CONTROL TRANSFORMER.
6. EXISTING CONTACTOR TO BE REUSED.
7. REMOVE EXISTING TRANSFORMERS, STARTER AND LOAD CENTRE. SPLICE 5 KV TECK CABLE IN JOINT BOX AND REINSTALL CABLE ON NEW PIPELINE.
8. REMOVE EXISTING COMMON CABLES AND RECEIVER CONTROL CABINET.
9. HEAT TRACE ALL WATER PIPES, VALVES IN JUNCTION BOX AND NEW SUBMERSED INTAKE LINE.
10. EXISTING CONTACTOR TO BE REUSED
11. INSTALL NEW 50A, 2 POLE BREAKER C/W AUX. SWITCH AND SHUNT TRIP C/W ENCLOSURE.
12. RECONNECT EXISTING OVERFLOW PIPE TRACE CABLE TO NEW GFCI BREAKER
13. NEW 30A, 2 POLE CONTACTOR IN EEMAC 1 ENCLOSURE TO REPLACE EXISTING.
14. NEW 300 #14 TECK STRAPPED TO PIPE BACK. (NO SPLICES)
15. INSTALL TERMINAL BLOCKS FOR GFCI ALARMS, PUMP'S START/STOP, STATUS AND FAULT I/O AS REQUIRED.
16. NEW 20A, 1 POLE CONTACTOR IN EEMAC 1 ENCLOSURE.

NOTE:

LOCATION OF STRUCTURES AND COMPONENTS ARE BASED IN PART BY INFORMATION PROVIDED BY OTHERS. NO GUARANTEE IS GIVEN THAT ALL STRUCTURES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND LOCATION OF ALL ITEMS MUST BE CONFIRMED BY THE CONTRACTOR.

LEGEND

- CIRCUIT BREAKER
- MOTOR STARTER C/W OVERLOAD HEATERS, SIZE 0
- 30A, 3 POLE DISCONNECT SWITCH
- MOTOR 3 HORSE POWER
- HEAT TRACE CABLE
- JUNCTION BOX
- GROUND FAULT RELAY ALARM/TRIP, 30 mA
- GROUND ELECTRODES (2) 3000mm APART

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RECORD DRAWING

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CHANGE	DATE	DESCRIPTION	CHECK
4	DEC/02	RECORD DRAWING	GS
3	APR/01	ISSUED FOR TENDER	KAG
2	JAN/01	100% REVIEW	KAG

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
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THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER P 010
M. M. DILLON LIMITED

DILLON CONSULTING

Nunavut

PROJECT
WATER SUPPLY PIPELINE REPLACEMENT
CAPE DORSET, NUNAVUT

TITLE
INTAKE AND JUNCTION BOX DETAILS

SCALE: AS SHOWN

PROJECT NUMBER: 007879

DRAWING NUMBER: 105

PANEL	LOCATION	TYPE	MOUNTING	MAINS	MAIN BRKR	MIN. INTERRUPTING CAPACITY (Ka RMS)	BRANCH BREAKERS
LA	–		SURFACE	100A	–	10 Ka	

NOTES: 120/208V, 3ø, 4 WIRE
(EXISTING PANEL)

	CCT. NO.	BREAKER AMPS.	BREAKER POLES	LOAD DESCRIPTION	LOAD A	LOAD B	LOAD C	CCT. NO.	BREAKER AMPS.	BREAKER POLES	LOAD DESCRIPTION	LOAD A	LOAD B	LOAD C	
	1	40	1	SPARE				2	30	2	PIPE HEAT TRACE	1250			G
	3	15	1	EXITING HEAT		1000		4					1250		
	5	15	1	EXITING RECEPTACLE			1000	6	15	1	SPARE				
	7	15	1	RECEPTACLE AND LIGHT	250			8			SPARE				
G	9	15	1	OVERFLOW TRACE CABLE		450		10			"				
G	11	15	1	EMERGENCY THAW CABLE			1000	12			"				
G	13	20	1	SUBMERSED INTAKE HEATER	660			14			"				
	15	15	1	SPARE				16			"				
	17	15	1	"				18			"				

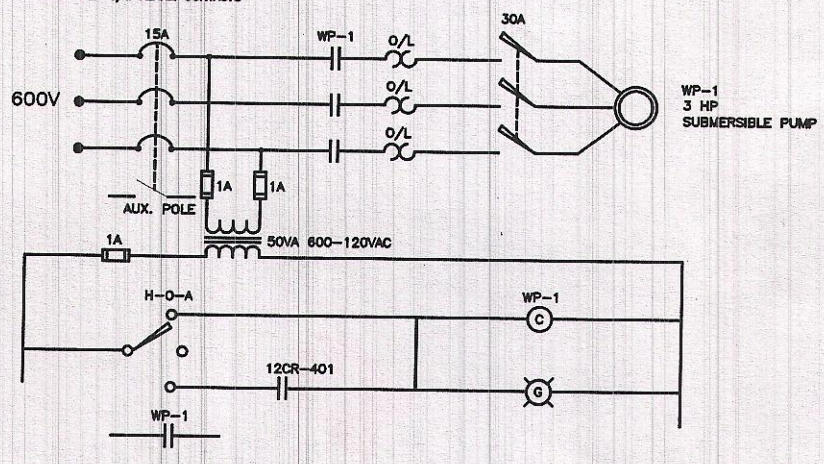
G = GFCI BREAKER C/W ALARM CONTACTS

PANEL	LOCATION	TYPE	MOUNTING	MAINS	MAIN BRKR	MIN. INTERRUPTING CAPACITY (Ka RMS)	BRANCH BREAKERS
CDP-PA	–		SURFACE	225A	–	10 Ka	

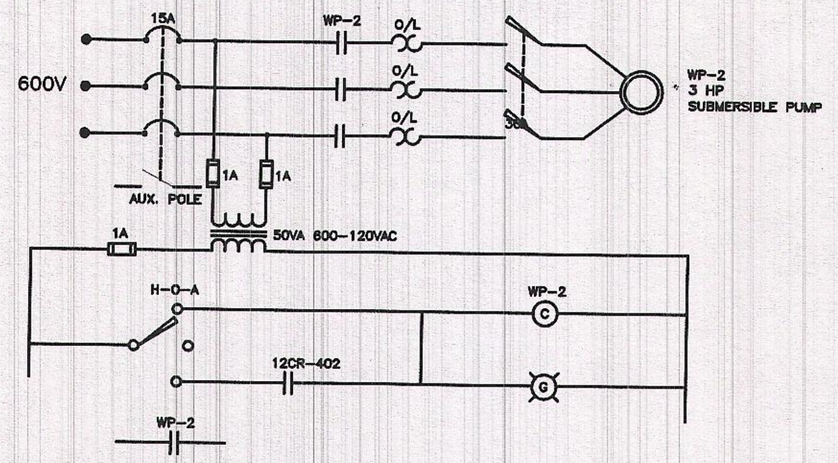
NOTES: 347/600V, 3ø, 4 WIRE

CCT. NO.	BREAKER AMPS.	BREAKER POLES	LOAD DESCRIPTION	LOAD A	LOAD B	LOAD C	CCT. NO.	BREAKER AMPS.	BREAKER POLES	LOAD DESCRIPTION	LOAD A	LOAD B	LOAD C	
1				1000			2				2160			
3	40	3	IMMERSION HEATER EC-1		1000		4	20	3	15kVA TRANSFORMER		2700		
5						1000	6				-		2000	
7				1000			8				1700			
9	40	3	IMMERSION HEATER EC-2		1000		10	15	3	UNIT HEATER STANDBY		1700		
11						1000	12						1700	
13				1700			14	15	1	SPARE				
15	40	3	UNIT HEATER #1		1700		16	50	2	PIPELINE HEAT TRACE HC-3		6300		G
17						1700	18						6300	
19				1000			20	15	1	SPARE				
21	15	3	INTAKE PUMP WP-1		1000		22	15	1	SPARE				
23						1000	24			SPACE				
25				1000			26			"				
27	15	3	INTAKE PUMP WP-2		1000		28			"				
29						1000	30			"				
31	15	1	SPARE				32			"				
33	15	1	SPARE				34			"				
35			SPACE				36			"				
37			"				38			"				
39			"				40			"				
41			"				42			"				

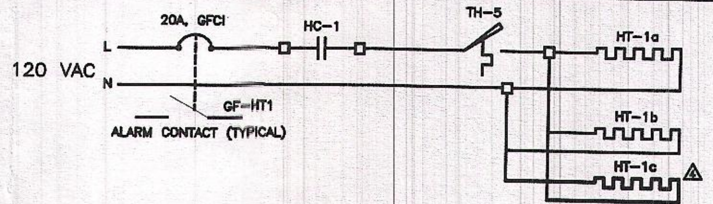
G = GFCI BREAKER C/W ALARM CONTACTS



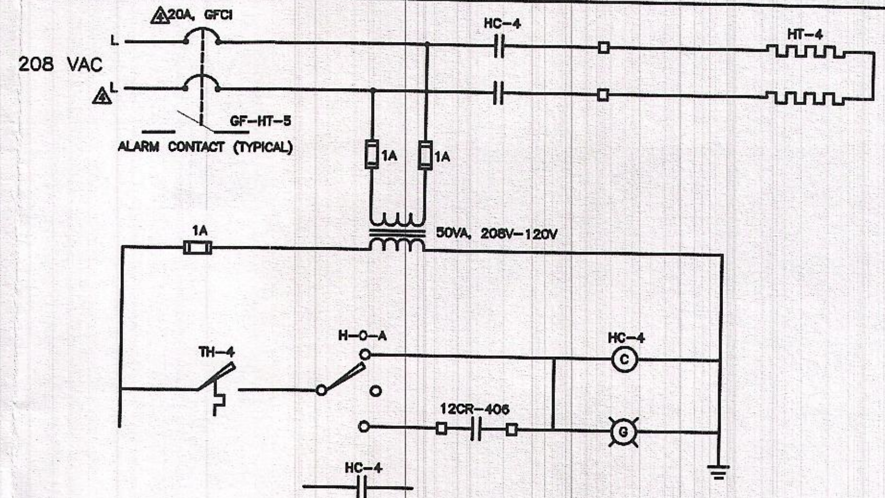
SUBMERSIBLE PUMP 'WP-1' WIRING SCHEMATIC



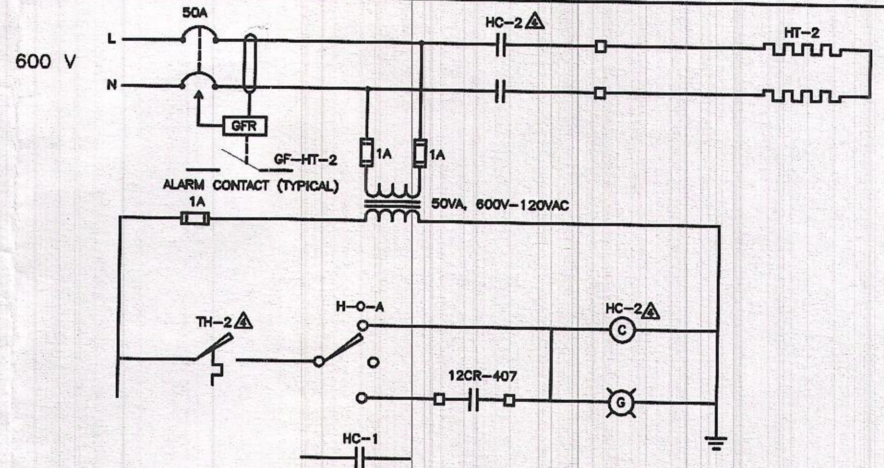
SUBMERSIBLE PUMP 'WP-2' WIRING SCHEMATIC



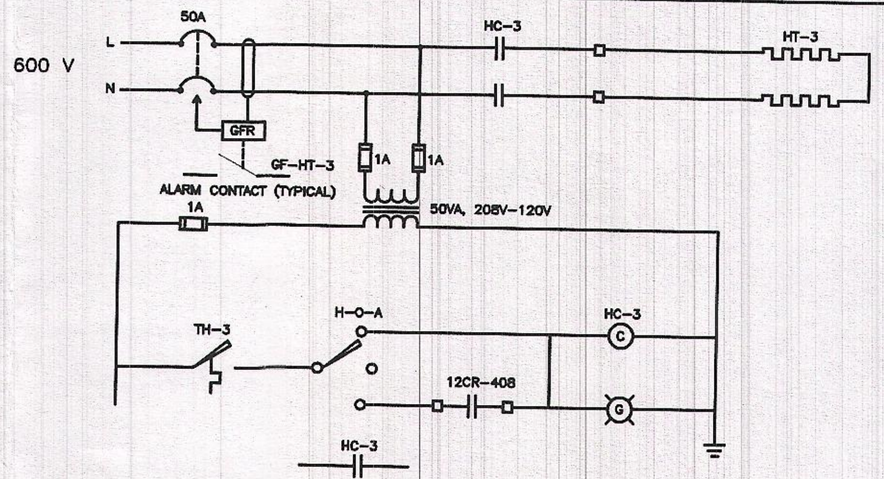
SUBMERSIBLE HEAT TRACE 'HT-1a,1b & 1c' SCHEMATIC



INTAKE PIPELINE TRACE 'HT-4' SCHEMATIC



PIPELINE HEAT TRACE 'HT-2' SCHEMATIC



PIPELINE HEAT TRACE 'HT-3' SCHEMATIC

RECORD DRAWING

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CHANGE	DATE	DESCRIPTION	CHECK
4	DEC/02	RECORD DRAWING	GS
3	APR/01	ISSUED FOR TENDER	KAG

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
ACN	CLC	ACN	DEC 02

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER P 018
M. M. DILLON LIMITED

REGISTERED PROFESSIONAL ENGINEER N.W.T.

DILLON CONSULTING

Nunavut

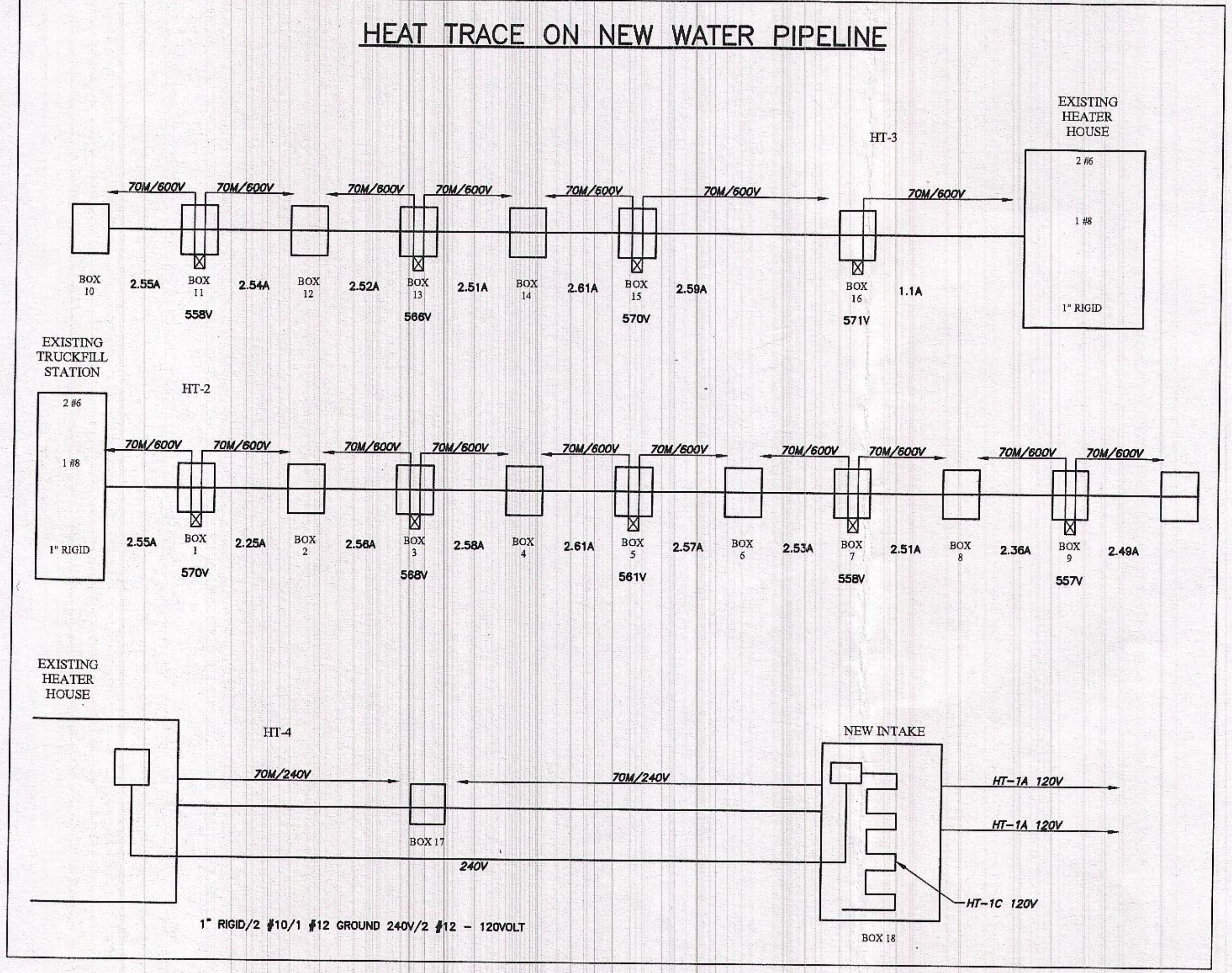
PROJECT
WATER SUPPLY PIPELINE REPLACEMENT
CAPE DORSET, NUNAVUT

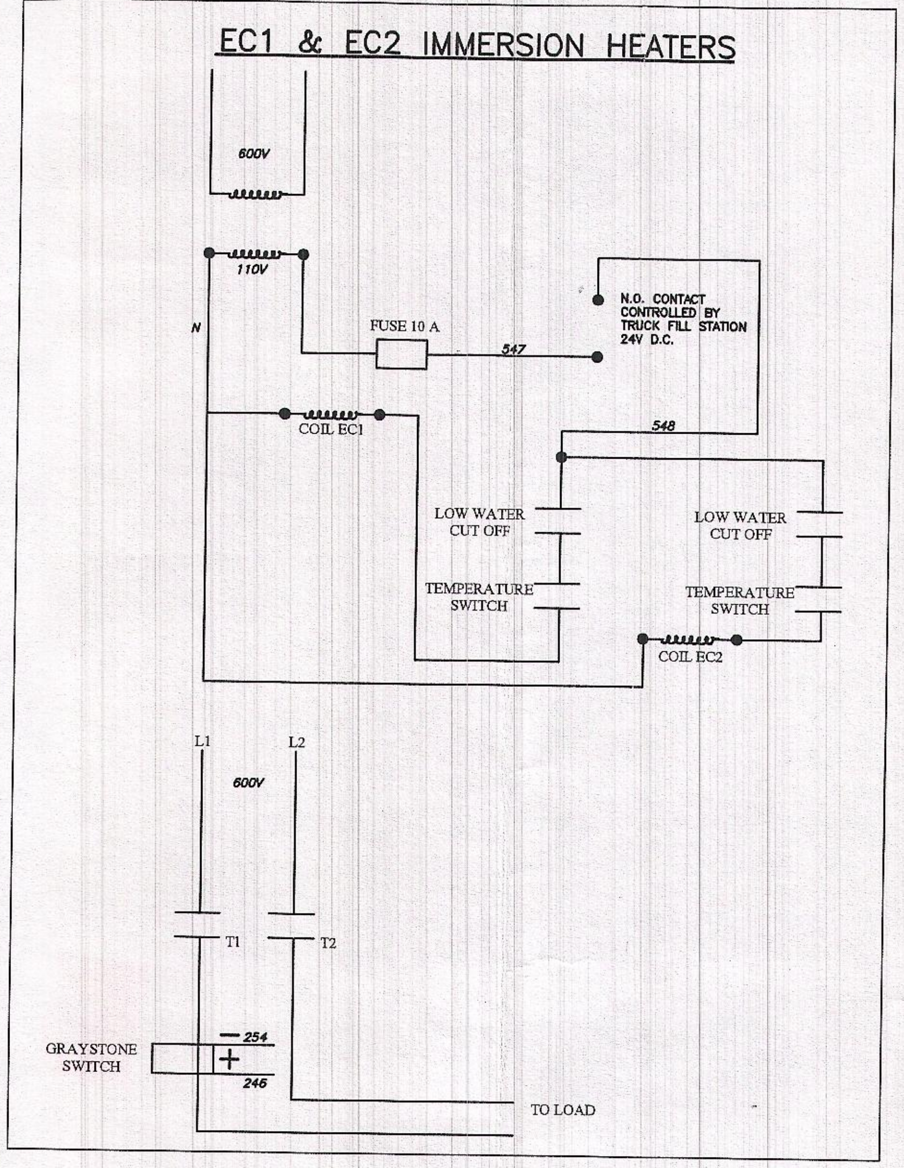
TITLE
ELECTRICAL PANEL AND CONTROL SCHEMATICS

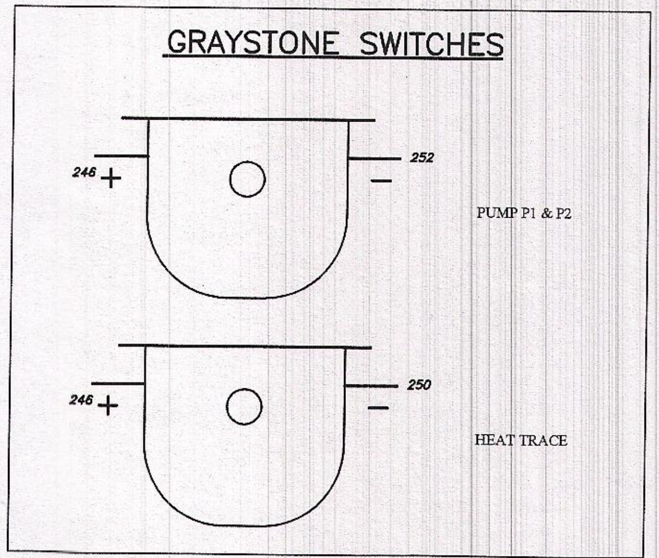
SCALE: AS SHOWN

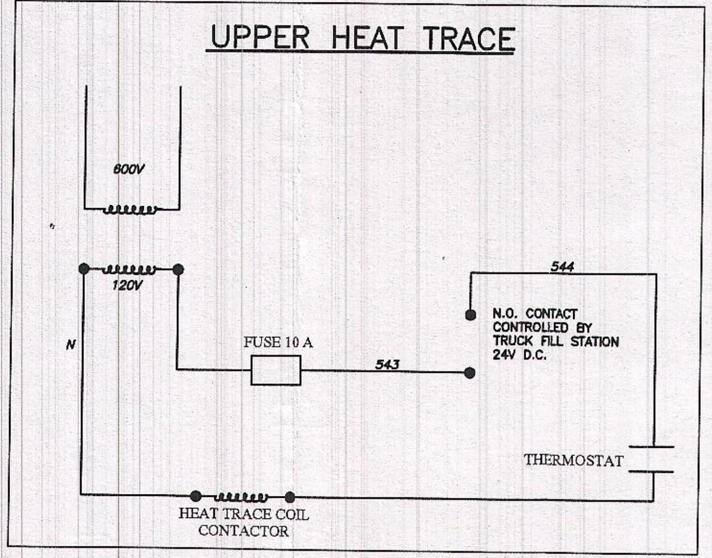
PROJECT NUMBER: 007879

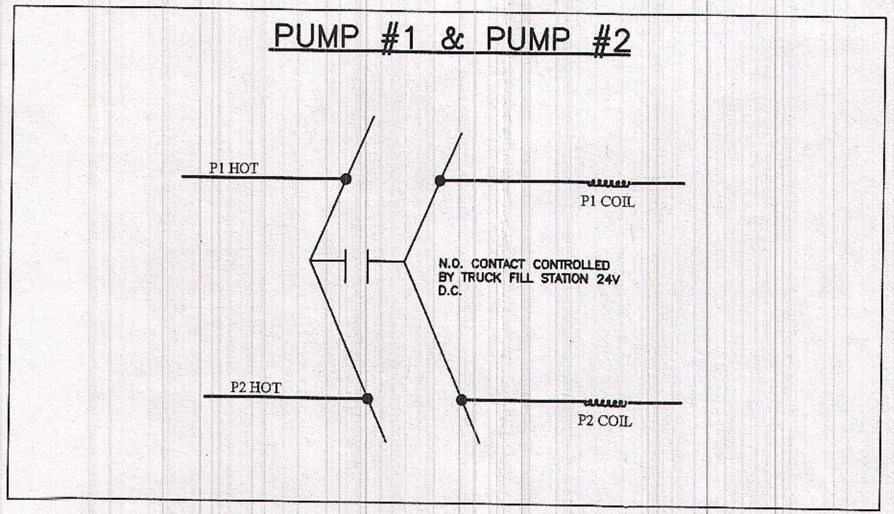
DRAWING NUMBER: 106











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RECORD DRAWING

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CHANGE	DATE	DESCRIPTION	CHECK
4	DEC/02	RECORD DRAWING	GS
3	APR/01	ISSUED FOR TENDER	KAG
2	JAN/01	100% REVIEW	KAG
1	JAN/01	80% REVIEW	KAG
0	AUG/00	ISSUED FOR REVIEW	KAG

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
AN	TPW	KAG	DEC 02

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER
M. M. DILLON LIMITED

DILLON CONSULTING

Nunavut

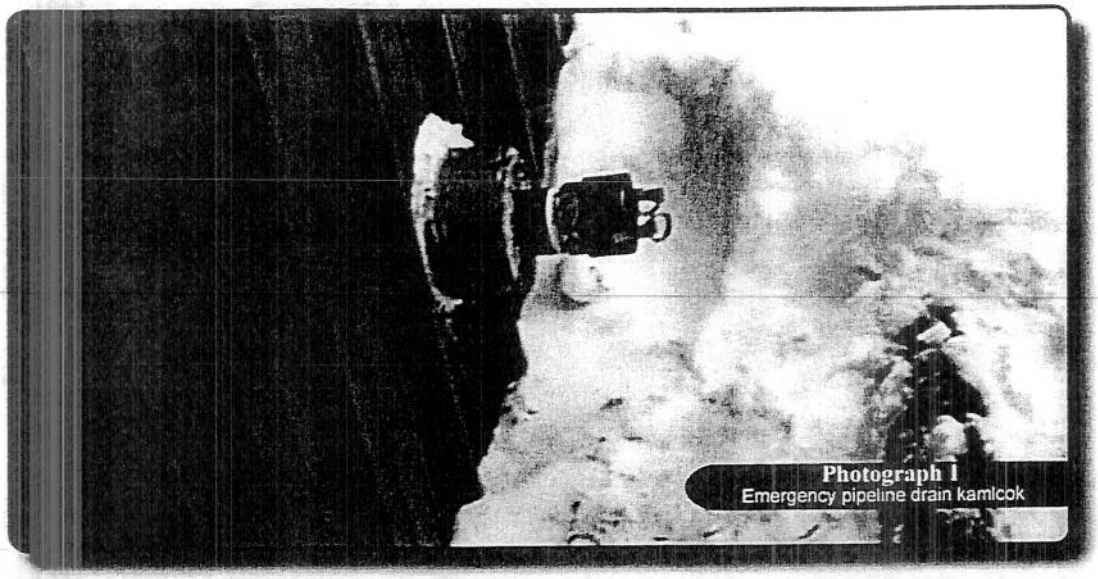
PROJECT
WATER SUPPLY PIPELINE REPLACEMENT
CAPE DORSET, NUNAVUT

TITLE
ELECTRICAL CONTROLS

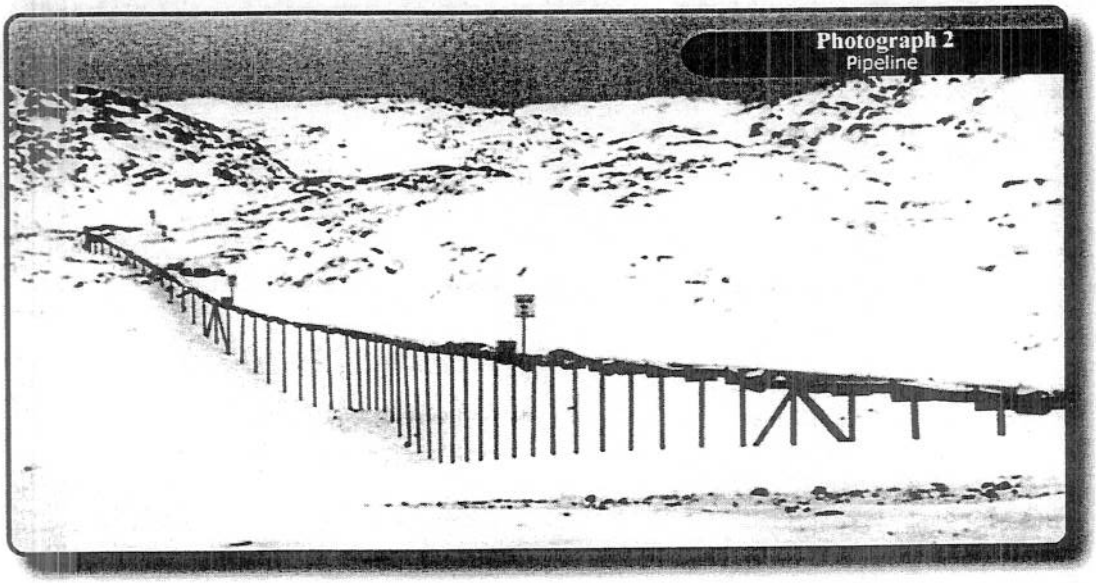
SCALE
NOT TO SCALE

PROJECT NUMBER
007879

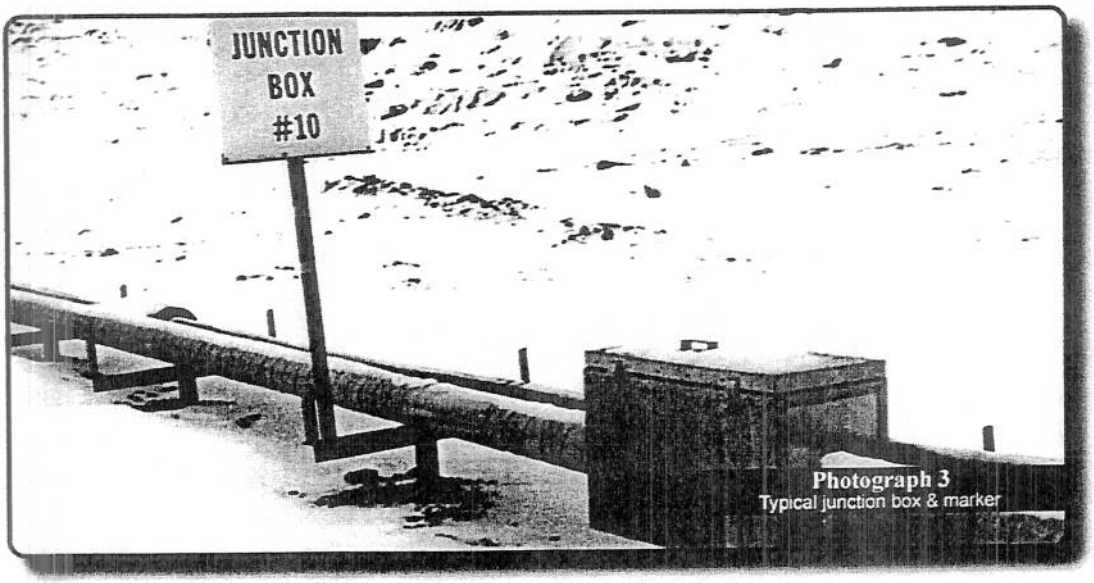
DRAWING NUMBER
4 107



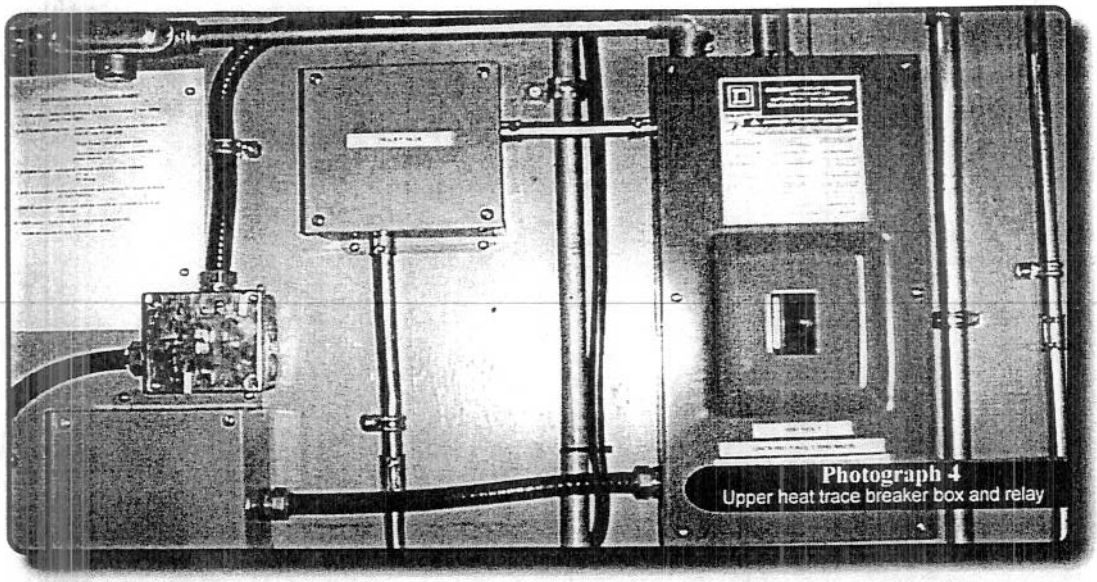
Photograph 1
Emergency pipeline drain kamlcok



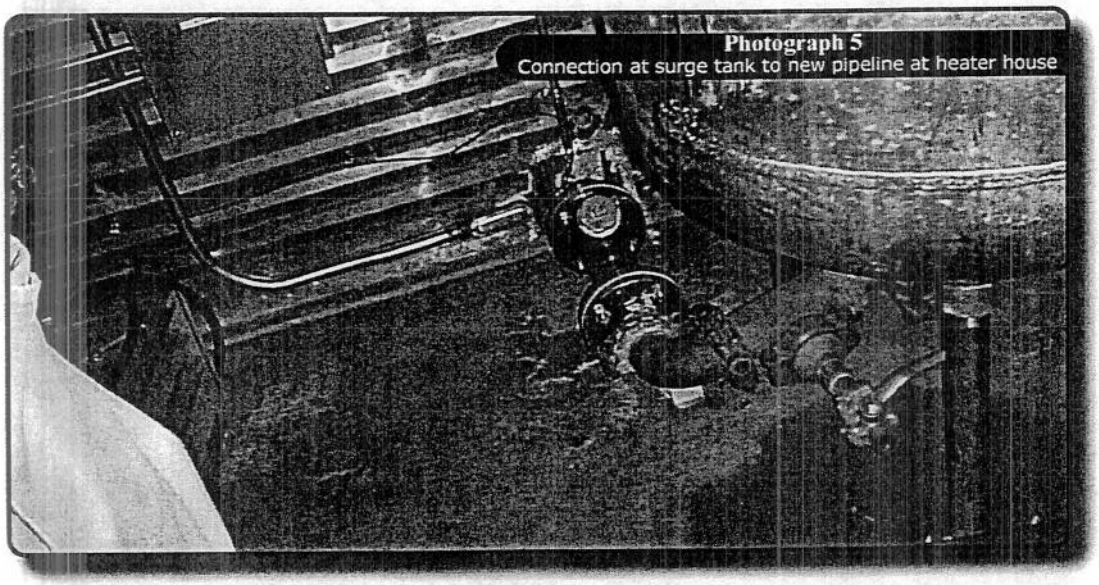
Photograph 2
Pipeline



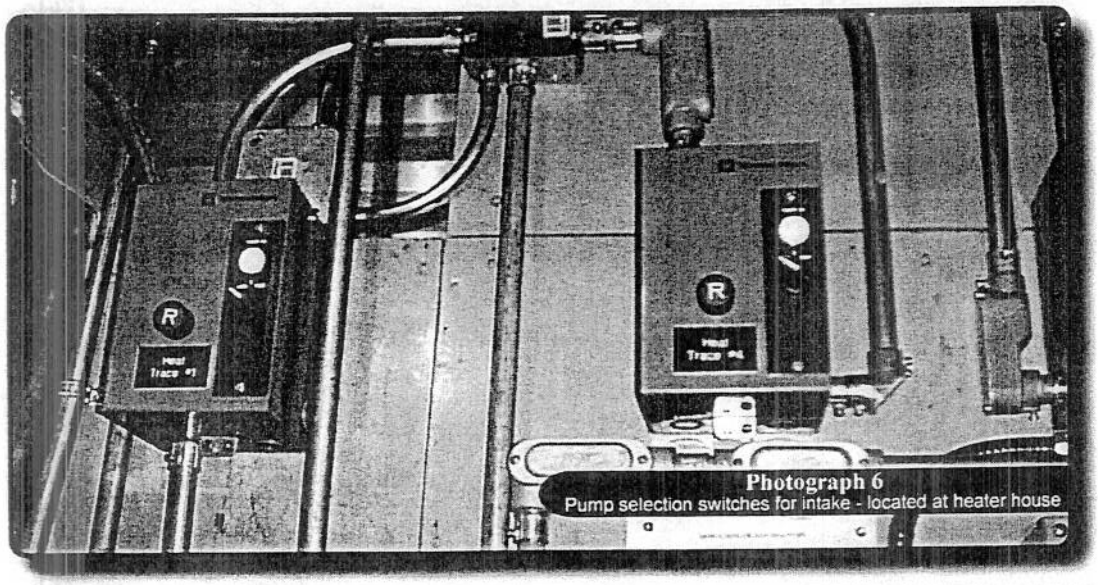
Photograph 3
Typical junction box & marker



Photograph 4
Upper heat trace breaker box and relay



Photograph 5
Connection at surge tank to new pipeline at heater house



Photograph 6
Pump selection switches for intake - located at heater house