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TRANSMITTAL

C N R

TRANSMITTAL No. **14-0434-005-00004**

PROJECT : 14-0434-005 Hornepayne Yard Operational Manual

TO : Mr. Kirk Crosson
Ministry of the Environment
70 Foster Drive
Suite 110
Sault Ste. Marie ON P6A 6V4

FROM : Nick Tropea
KGS Group

DATE : December 22, 2014

SUBJECT : Hornepayne Yard Operations Manual

SUBMITTED FOR : ☐ Approval ☑ Your Use ☐ As Requested ☐ Review and Comment

SENT VIA :

ITEM	DESCRIPTION	STATUS
RPT	Title: Hornepayne Yard Operations Manual for Certificate of Approval (RPT), Revision: (0, Dec 22, 2014)	Issued for Use

REMARKS : As per the request of Nick Tropea, the Final Operations Manual regarding CN Hornepayne Yard is being sent via Purolator Courier.

Regards,

Stacy Allison
Document Control

COPIES TO :

KGS Group
Tony Gallo

SAULT STE. MARIE
MINISTRY OF ENVIRONMENT

DEC 2 4 2014

RECEIVED

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December 22, 2014

File No. 14-0434-005

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SAULT STE. MARIE
MINISTRY OF ENVIRONMENT
DEC 24 2014
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ATTENTION: Mr. Aaron Stadnyk, P. Eng
Environmental Officer – Ontario

RE: CN Hornepayne Yard Operations Manual
Certificate of Approval No. 3528-83LQWT
Final Report

Dear Mr. Stadnyk:

Please find enclosed one (1) hard copy of the Operations Manual for the above mentioned site. For your convenience, one (1) electronic copy of the Operations Manual has been forwarded to Ms. Carolyn David.

KGS Group sincerely appreciates the opportunity to have been of service on this project. If you have any questions regarding this report, please contact Mr. Nick Tropea of our Thunder Bay office at (807) 623-2195 or the undersigned.

Yours truly,

Tony Gallo, M.Sc., EP
Senior Environmental Scientist

NT/sla
/Enclosure

cc: Carolyn David, P. Eng., M. Eng., CN Environmental Coordinator

Canadian National
Hornepayne Yard
Operations Manual for Certificate of Approval
No. 3528-83LQWT

FINAL REPORT

December 2014

Prepared By

Nick Tropea, B.Sc.
Senior Environmental Technologist

Reviewed By

Tony Gallo, M.Sc., EP
Senior Environmental Scientist

KGS Group
Thunder Bay, Ontario

TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 WEST END DIESEL RECOVERY SYSTEM 2
2.1 INTRODUCTION 2
2.2 SYSTEM OPERATION 2
2.2.1 System Overview 2
2.2.2 System Components 2
2.3 OPERATION AND MAINTENANCE 8
2.3.1 Inspections 8
2.3.2 Operation and Maintenance Schedule 8
2.4 EFFLUENT FLOW MONITORING AND SAMPLING 10
2.4.1 Effluent Flow Monitoring 10
2.4.2 Effluent Flow Sampling 10
3.0 LAGOON NO.2 LNAPL CONTAINMENT SYSTEM 12
3.1 INTRODUCTION 12
3.2 SYSTEM OPERATION 13
3.2.1 System Overview 13
3.2.2 System Components 13
3.3 OPERATION AND MAINTENANCE 22
3.3.1 Inspections 22
3.3.2 Operation and Maintenance Schedule 22
3.4 EFFLUENT FLOW MONITORING AND SAMPLING 24
3.4.1 Effluent Flow Monitoring 24
3.4.2 Effluent Flow Sampling 25
4.0 FORMER SHOP TRACK DIESEL RECOVERY SYSTEM 26
4.1 INTRODUCTION 26
4.2 SYSTEM OPERATION 26
4.2.1 System Overview 26
4.2.2 System Components 26
4.3 OPERATION AND MAINTENANCE 29
4.3.1 Inspections 29
4.3.2 Operation and Maintenance Schedule 29
4.4 SURFACE WATER / EFFLUENT SAMPLING 30
5.0 WASTE TRANSFER FACILITY 31
5.1 INTRODUCTION 31
5.2 SYSTEM OPERATION 31
5.2.1 System Overview 31
5.2.2 System Components 31
5.3 OPERATIONS AND MAINTENANCE 37
5.3.1 Inspections 37
5.3.2 Operating and Maintenance Schedule 37
5.4 SURFACE WATER / EFFLUENT SAMPLING 38
6.0 REPORTING 39
7.0 SPILL RESPONSE PLAN 40
8.0 HEALTH AND SAFETY PLAN 41
8.1 GENERAL 41
8.2 OPERATION SAFETY 41
8.3 PERSONAL PROTECTIVE EQUIPMENT 42
8.4 PROHIBITIONS 42

LIST OF FIGURES

1. Site Location Plan
2. Yard Location Plan – West End
3. West End Diesel Recovery System Components
4. West End Diesel Recovery System Schematic
5. Yard Location Plan – Lagoon No.2 Area
6. Lagoon No.2 LNAPL Containment System Components
7. Lagoon No.2 LNAPL Containment System Schematic
8. Yard Location Plan – Shop Track Area
9. Former Shop Track Fuelling Area System Components
10. Shop Track Diesel Recovery System and Waste Transfer Facility System Schematic
11. Yard Location Plan – Waste Transfer Facility
12. Waste Oil Transfer Facility System Components

LIST OF APPENDICES

A. Emergency Response Plan
B. Abbreviated System Inspection Form
C. West End Diesel Recovery System Inspection Form
D. Lagoon No. 2 LNAPL Containment System Inspection Form
E. Shop Track Diesel Recovery System and Waste Transfer Facility Inspection Form
F. Abanaki Oil Grabber Model 8 Oil Skimmer Manual
G. Lagoon No. 2 OWS Specifications
H. Air Compressor Manual
I. Refrigerated Air Dryer Manual
J. QED AP-4 Total Fluid Pump Manual
K. Sewage Pump Manual
L. Myers WHRS Series Manual
M. Pressure Transducer Calculations
N. Certificate of Approval No. 3528-83LQWT

1.0 INTRODUCTION

The following operation and maintenance manual has been prepared on behalf of Canadian National (CN) to provide environmental and engineering support with respect to the ongoing management of various light non-aqueous phase liquid (LNAPL) recovery and containment systems at CN Hornepayne Yard, located in Hornepayne, Ontario (Figure 1). The four (4) systems in place at the Yard are the West End Diesel Recovery System (DRS), Lagoon No.2 LNAPL Containment System (CS), Former Shop Track DRS, and the Waste Transfer Facility (WTF). The systems are operated under the Ontario Ministry of Environment (MOE) Certificate of Approval Number 3528-83LQWT (C of A), issued on April 29, 2010 (Appendix N). As per the requirements of the C of A, the operations manual describes each of the four (4) systems listed above, with respect to the operation and maintenance procedures and activities, including inspection frequency, effluent monitoring and sampling, reporting, and health and safety procedures implemented for each recovery and containment system at Hornepayne Yard.

2.0 WEST END DIESEL RECOVERY SYSTEM

2.1 INTRODUCTION

Construction of the West End DRS commenced in 1997 and was completed in 1998. The West End DRS was constructed as part of the Phase IV Remedial Action Plan implemented by CN to address environmental concerns with respect to petroleum hydrocarbon (PHC) contamination identified at the west end of the Yard. The West End DRS was designed to "passively" contain and recover the PHC underlying the west end of the Yard with minimal operation and maintenance requirements. Physical containment of PHC is provided by the impermeable barrier installed on the north side of the retention lagoon, and on the retention weir. Figure 2 shows the location of the West End DRS in relation to the Yard location plan.

2.2 SYSTEM OPERATION

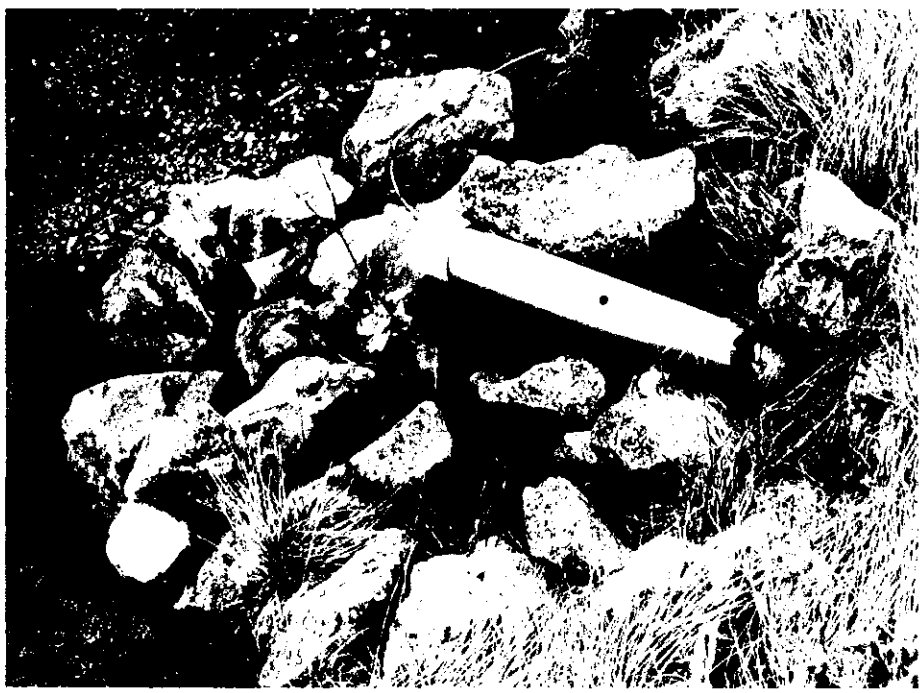
2.2.1 System Overview

The DRS was originally composed of eleven (11) underdrains, each at various elevations within the subsurface. Only ten (10) underdrains remain, as underdrain No.7 was destroyed in 1998 during construction of the diesel recovery lagoon. The underdrains run beneath the former fuelling stand and discharge total fluids into the diesel recovery lagoon. A skimmer unit, located within the skimmer building at the west end of the diesel recovery lagoon, collects LNAPL floating on the surface of the water within the diesel recovery lagoon. Collected LNAPL is transferred by gravity to a 25,000 litre (L) waste oil recovery tank. Effluent from the diesel recovery lagoon is discharged to a discharge trench. At the downstream end of the trench is a concrete control structure, through which effluent is discharged to the Little Jackfish River. Flow through the structure is controlled using a manual butterfly valve.

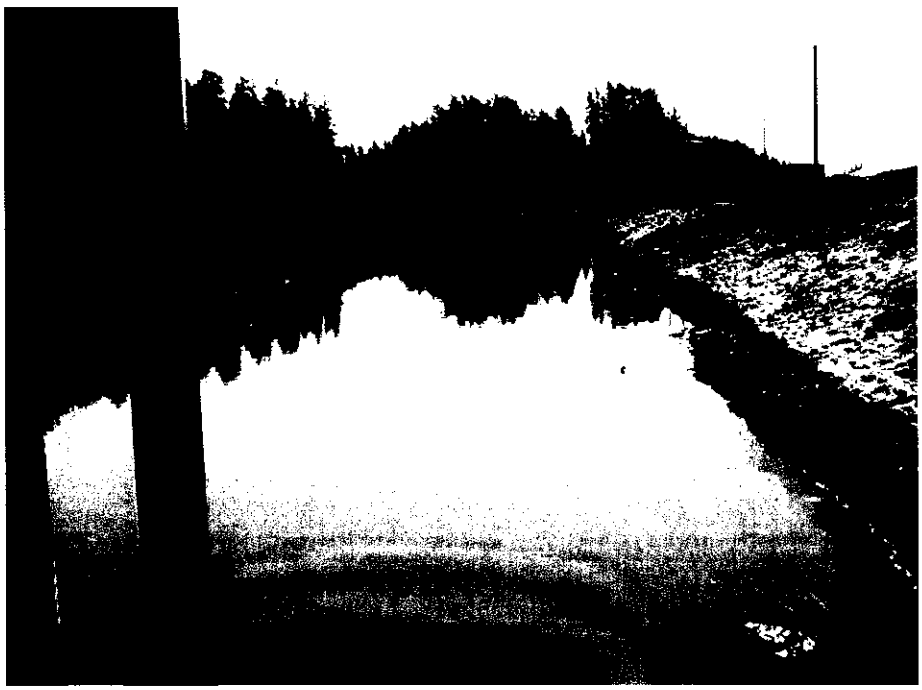
2.2.2 System Components

The West End DRS contains system components both inside and outside the skimmer building and are listed below. The locations of the system components are shown on Figure 3, and a schematic diagram of the system is presented on Figure 4.

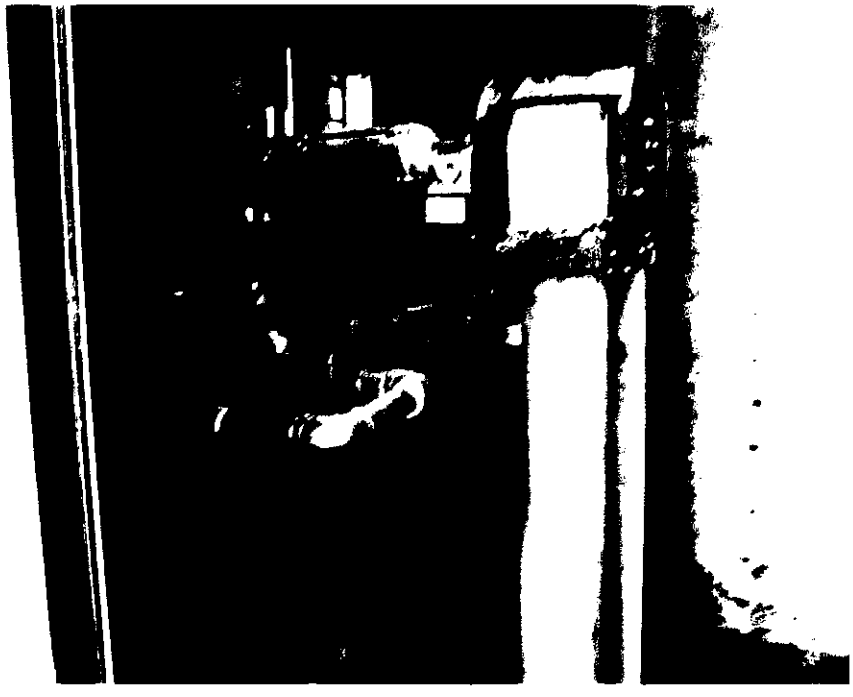
Underdrains – The underdrains were installed using directional drilling technology. A pilot hole was drilled along each underdrain line and then each hole was enlarged to a diameter of 180mm. A temporary 150mm diameter, high density polyethylene pipe casing was installed within each underdrain hole to support the hole and to facilitate the installation of the perforated underdrain pipe. Within each temporary pipe, a 100mm diameter drainage pipe was installed and the temporary casing was removed. Finally, a 50mm diameter perforated PVC insert was installed within each drainage pipe. Each underdrain line was installed beneath the former fuelling stand. Total fluids (LNAPL and groundwater) collected within each pipe drain by gravity to the diesel recovery lagoon.



Diesel Recovery Lagoon – The diesel recovery lagoon is situated to the east of the Little Jackfish River. The diesel recovery lagoon is approximately 160 meters in length and approximately 6 meters in width, and has a maximum liquid retention capacity of approximately 960,000 L. The north side of the diesel recovery lagoon is lined with a 20mm impermeable PVC geomembrane and is covered by nonwoven geotextile. The south side of the diesel recovery lagoon is unlined to facilitate the migration of PHC to the lagoon. Total fluids collect in the lagoon. LNAPL is "skimmed" from the surface of the diesel recovery lagoon and is transferred to the waste oil recovery tank. Groundwater, collected within the diesel recovery lagoon discharges to the diesel recovery trench, and ultimately, beyond the concrete control structure to the Little Jackfish River.



Skimmer Unit – The Abanaki Oil Grabber Model 8 Oil Skimmer unit is located in the skimmer building. The skimmer unit consists of a hydrophobic skimmer belt, yolk and cage assembly and decanter unit. The skimmer belt is suspended within a 1000mm diameter, slotted corrugated metal pipe, which allows PHC and water to enter. LNAPL floating on the surface of the diesel recovery lagoon within the corrugated metal pipe is collected by the hydrophobic skimmer belt and discharged to the decanter unit. Recovered LNAPL drains by gravity from within the decanter unit to the waste oil recovery tank, while any water collected, drains back to the diesel recovery lagoon. The Abanaki Oil Grabber Model 8 Oil Skimmer Manual is provided in Appendix F.



Waste Oil Recovery Tank – The 25,000 L double walled waste oil recovery tank is located outside, adjacent to the skimmer building. The waste oil recovery tank is equipped with an overfill sensor, which is connected to the skimmer unit, and automatically disables the operation of the skimmer unit when the waste oil recovery tank is full. Operation of the skimmer unit can only resume after the waste oil recovery tank has been emptied.



Diesel Recovery Trench – The diesel recovery trench is lined with a 20mm impermeable PVC geomembrane and overlain by a 300mm layer of granular material to protect and cover the liner. Water within the diesel recovery trench flows west towards Little Jackfish River and is contained by a concrete control structure. The concrete control structure is complete with a gate valve to control the flow of water to the Little Jackfish River, which serves as the monthly sampling location.





2.3 OPERATION AND MAINTENANCE

2.3.1 Inspections

The West End DRS is inspected weekly by local personnel and on a monthly basis by the consultant throughout the operating year (May to November). Operation of the system is recorded on an abbreviated inspection form for weekly inspections and a more detailed inspection form during monthly system inspections. Both inspection forms can be found in Appendix B and Appendix C, respectively.

2.3.2 Operation and Maintenance Schedule

The following sections provide a synopsis of the operation and maintenance inspection schedule and procedures. All activities related to system performance and maintenance activities are documented and included in Monthly Environmental Status Reports and the Annual Report provided to CN.

Weekly

Throughout the operating year (typically May through November), local personnel perform an abbreviated weekly inspection. During weekly inspections, local personnel conduct the following duties:

- Inspect the operation of the skimmer unit and perform skimmer unit maintenance,
- Monitor lines and tanks for any signs of leaks,
- Monitor LNAPL and water level measurements in the waste oil recovery tank, and
- Record visual observations with respect to LNAPL / PHC sheen in the diesel recovery lagoon, diesel recovery trench, and the Little Jackfish River.

The CN Environmental Officer is contacted immediately by the consultant if PHC sheen is present in the Little Jackfish River or if monthly laboratory effluent results exceed the applicable MOE C of A criteria.

Weekly abbreviated inspection forms are completed by local personnel and sent via email to the consultant for review. The originals are kept on site.

Monthly

Throughout the operating year, the consultant performs monthly detailed inspections, which consist of the following duties:

- All West End DRS components are inspected and tested. The West End DRS components include the underdrains, diesel recovery lagoon, skimmer unit, waste oil recovery tank, and diesel recovery trench,
- Collected water in the skimmer unit decanter is manually drained and maintenance is completed on all skimmer unit components (skimmer blades, collection chamber, decanter),
- Monitor all lines and tanks for any signs of leaks,
- LNAPL and water levels are monitored in the diesel recovery lagoon, waste oil recovery tank, and selected monitoring wells (MW-10, MW-11, MW-12, MW-120, MW-122, OW8-2, and OW9-3),
- Manually bail any LNAPL which is present within the monitoring well network and place into the waste oil recovery tank,
- Record visual observations with respect to LNAPL / PHC sheen in the diesel recovery lagoon, diesel recovery trench and the Little Jackfish River,
- Procure monthly effluent samples from the diesel recovery trench discharge to the Little Jackfish River (HOR-013-05), and
- Remove the data logger, located within the diesel recovery trench, and download the collected effluent flow data from the data logger. The calibration of the data logger and monthly flow data is conducted on a monthly basis.

The CN Environmental Officer is contacted immediately by the consultant if LNAPL / PHC sheen is present in the Little Jackfish River or if monthly laboratory effluent results exceed the applicable MOE C of A criteria.

Monthly inspection forms are completed by the consultant. Duplicate copies are made by the consultant for record keeping and the original copies are kept on site.

System Maintenance

Maintenance of the West End DRS components is conducted on an as required basis throughout the operating year.

2.4 EFFLUENT FLOW MONITORING AND SAMPLING

2.4.1 Effluent Flow Monitoring

At the beginning of each operating year, a transducer is installed in the diesel recovery trench to measure and record the height of the water column in order to calculate the effluent flow rate from the west end. The transducer is installed in the diesel recovery trench, up gradient of the final effluent discharge point to the Little Jackfish River (Figure 4).

The data logger is placed within a protective "pipe and block" assembly to ensure that the data logger remains protected, and that the data logger maintains its vertical position for accurate measurement of water depth. A continuous monitoring barometric pressure logger is also installed in the west end, in conjunction with the data logger, to calibrate the water depth measurements, which are impacted by changes in atmospheric pressure. The data loggers are pre-set to obtain water depth readings on an hourly basis. Data from each logger is manually downloaded on a monthly basis to ensure that the loggers continue to function as required, and to minimize data loss due to equipment malfunction or other issues. Pressure transducer theory and calculations are provided in Appendix M.

2.4.2 Effluent Flow Sampling

Effluent samples are collected on a monthly basis throughout the operating year from the diesel recovery trench final discharge (HOR-013-05) to the Little Jackfish River. Throughout the operating year (spring, summer, fall), additional surface water samples are procured throughout the Yard at various discharge points to the Little Jackfish River.

Bottles are placed in cooler chests with ice and submitted to Maxxam Analytics Inc., an accredited analytical testing facility, in Mississauga, Ontario. Each sample is analyzed for benzene, toluene, ethylbenzene, total xylenes (BTEX), total petroleum hydrocarbons (TPH), total extractable hydrocarbons (TEH), total mineral oil and grease (MOG), total oil and grease

(TOG), methyl-t-butyl-Ether (MTBE), pH, lead, alkalinity, and hardness. Laboratory analyses are reviewed and compared to the applicable MOE C of A criteria. Laboratory data is recorded and presented in both Monthly and Annual Performance Reports to CN. In the event of a laboratory result exceeding the applicable MOE C of A criteria, or if PHC sheen is observed in the Little Jackfish River, the CN Environmental Officer is immediately notified.

3.0 LAGOON NO.2 LNAPL CONTAINMENT SYSTEM

3.1 INTRODUCTION

Prior to 1997, there was no recovery system present in the Former Pump House Lagoon No. 2 area. In 1998, a bentonite / concrete slurry cut-off wall (cut-off wall) and two (2) active pumping wells, complete with top-loading total fluid groundwater pumps, were installed to provide hydraulic control. These measures had generally mitigated off-site impacts in this area; however, there were minor incidences of LNAPL discharges to the Little Jackfish River both during and after spring thaw and during high water events. Annual monitoring data indicated that LNAPL had begun to mound against the up gradient side of the cut-off wall. Ultimately, the concern was that if the mounding were left unchecked, LNAPL would begin to bypass the cut-off wall.

The recovery system was upgraded in the fall of 2006. The recovery system at Lagoon No.2 was enhanced with six (6) additional pumping wells and a new pumping system. In addition, an interception trench, including a collection sump, was installed to collect total fluids from the Former Pump House area. All underground electrical and plumbing was completed. A pollution control building was placed at the site. In the spring of 2007, plumbing lines were run from each pumping well to the pollution control building. Total fluid submersible pneumatic groundwater pumps were installed and the system was commissioned.

The recovery system was upgraded again in 2011 and 2013, respectively. A new, larger oil / water separator (OWS) was installed in October 2011 to replace the existing OWS, which was undersized for the application of this system. Also, a new air compressor was installed in May 2013 to replace the existing air compressor, which ceased operation in October 2012. The pollution control building was converted to the OWS building, while the existing storage shed was converted into the compressor building.

Figure 5 shows the location of the Lagoon No.2 LNAPL Containment System (CS) in relation to the Yard location plan.

3.2 SYSTEM OPERATION

3.2.1 System Overview

The Lagoon No.2 LNAPL CS contains system components located both inside and outside of the OWS building and the compressor building. Located inside the OWS building is a 45.4 gallon per minute OWS, transfer tank, and refrigerated air dryer, while the air compressor is located in the air compressor building. A horizontal waste oil tank, ten (10) pumping wells, an interception trench and collection sump, and Lagoon No.2 are located outside of both buildings. Five (5) submersible pneumatic pumps transfer total fluids from selected pumping wells to the OWS. The submersible pumps can be placed in any of the pumping wells within the network, depending on LNAPL thickness measured in the selected wells. Total fluids, collected from the interception trench and sump located approximately 100 m west of the air compressor building, are also pumped to the OWS. A submersible pump, transfers the total fluids from the interception trench into the OWS at the OWS building. An automatic float controls the level within the trench. Total fluids are processed by the OWS. LNAPL drains by gravity into a transfer tank. When LNAPL inside the transfer tank attains a set level (level switch), LNAPL is pumped into a 4,560 L, double walled waste oil tank. Effluent water from the OWS is discharged directly into Lagoon No.2. The locations of the system components are shown on Figure 6, and a schematic diagram of the system is presented on Figure 7.

3.2.2 System Components

To prevent the off-site migration of LNAPL into the Jackfish River, a cut-off wall was installed in 1995 at the northwest corner of Lagoon No.2. Pumping wells were installed to provide hydraulic control. Pumping wells PW-2, PW-4, PW-5 and PW-7 to PW-10 are located on the up gradient side of the cut-off wall, while pumping wells PW-3 and PW-6 are located on the down gradient side. Pumping well PW-1 was damaged during system modifications and upgrades and was considered a safety hazard; therefore, the pumping well was removed. Total fluid submersible pneumatic pumps control the water level within each respective pumping well, and pumps total fluids to the OWS.

Air Compressor Building – The air compressor building (foreground) was previously used as the storage building. The air compressor building was modified in 2013 and contains the new air compressor.

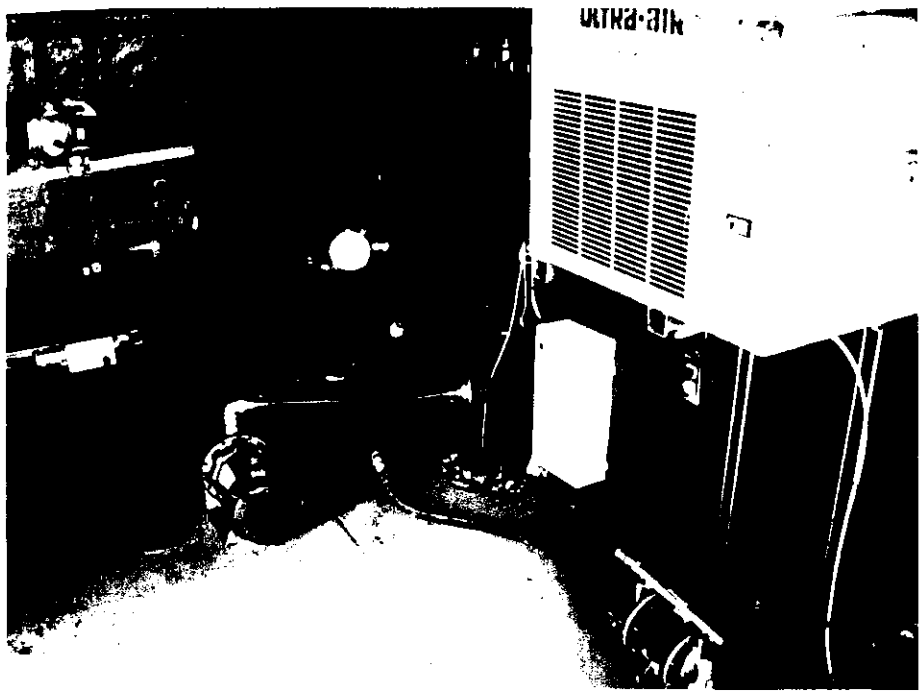
Oil / Water Separator Building – The OWS building (background) was previously named the pollution control building and contains system components.



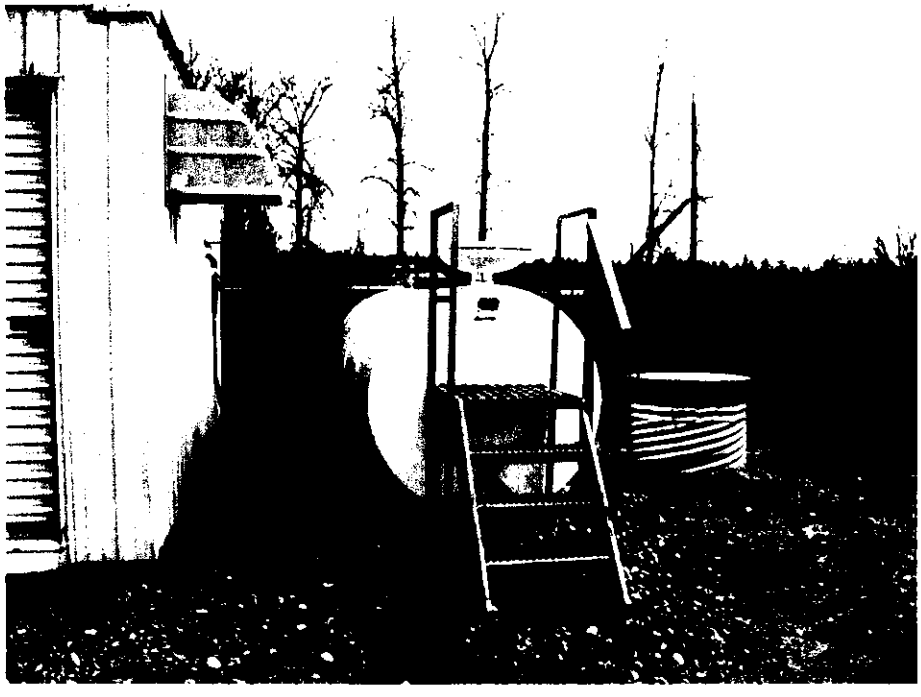
Oil / Water Separator – The OWS is located in the OWS building. Total fluids from the interception trench sump and the pumping well system at Lagoon No.2 are processed through the OWS. LNAPL accumulates in the retention chamber and drains by gravity into a transfer tank, located adjacent to the OWS in the OWS building. Effluent water is pumped directly to Lagoon No. 2. Specifications of the OWS are provided in Appendix G.



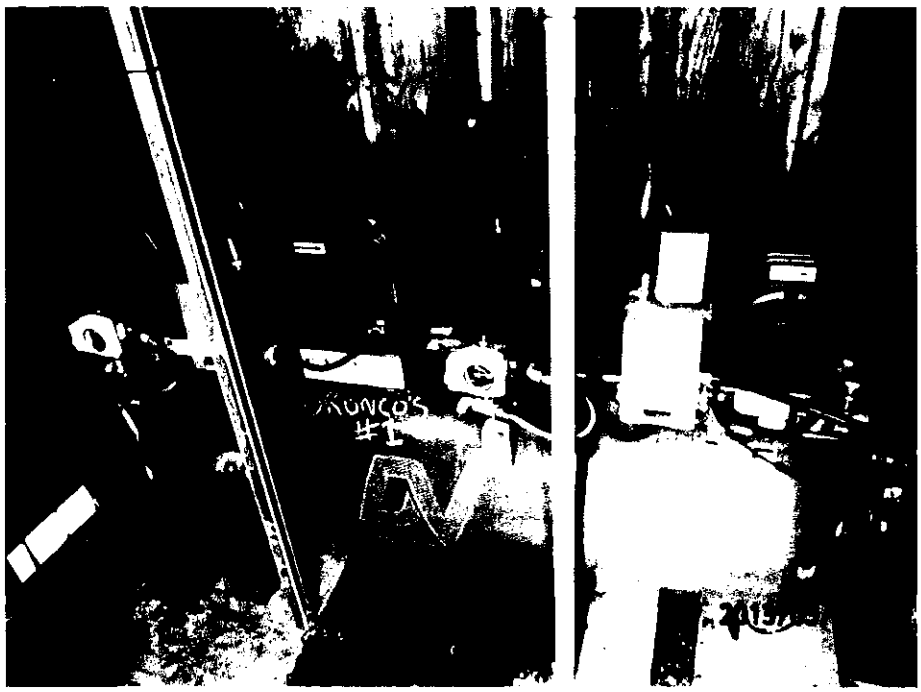
Transfer Tank – The transfer tank is located in the OWS building adjacent to the OWS. LNAPL drains by gravity from the OWS retention chamber into the transfer tank. When LNAPL reaches a set level in the tank (level switch), then the LNAPL is pumped into a 4,560 L double walled waste oil tank outside the OWS building.



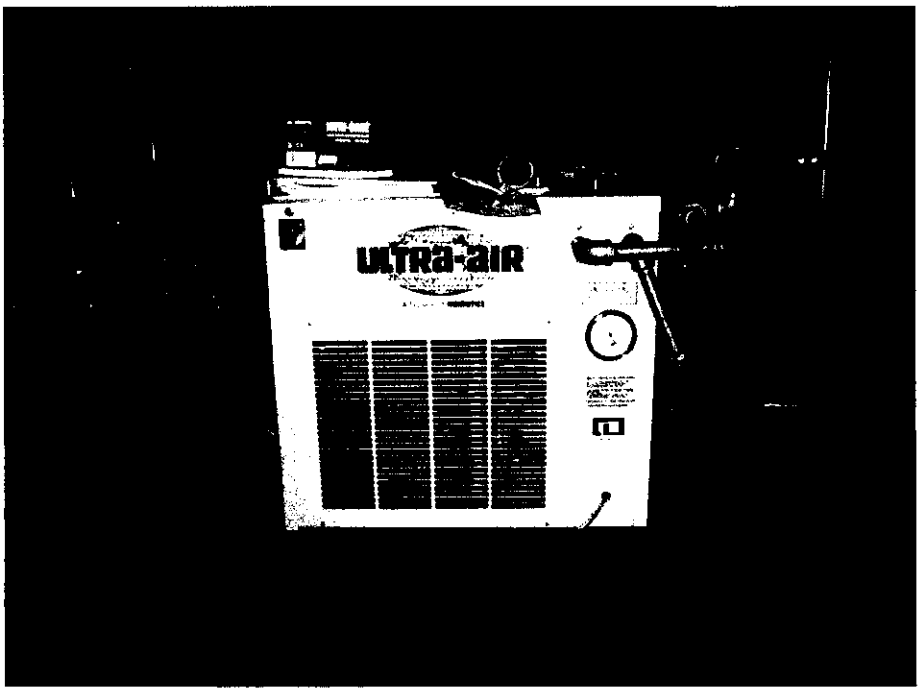
Waste Oil Tank – The 4,560 L double walled waste oil tank is located outside, directly adjacent to the OWS building. Collected LNAPL pumped from the transfer tank is stored in this tank.



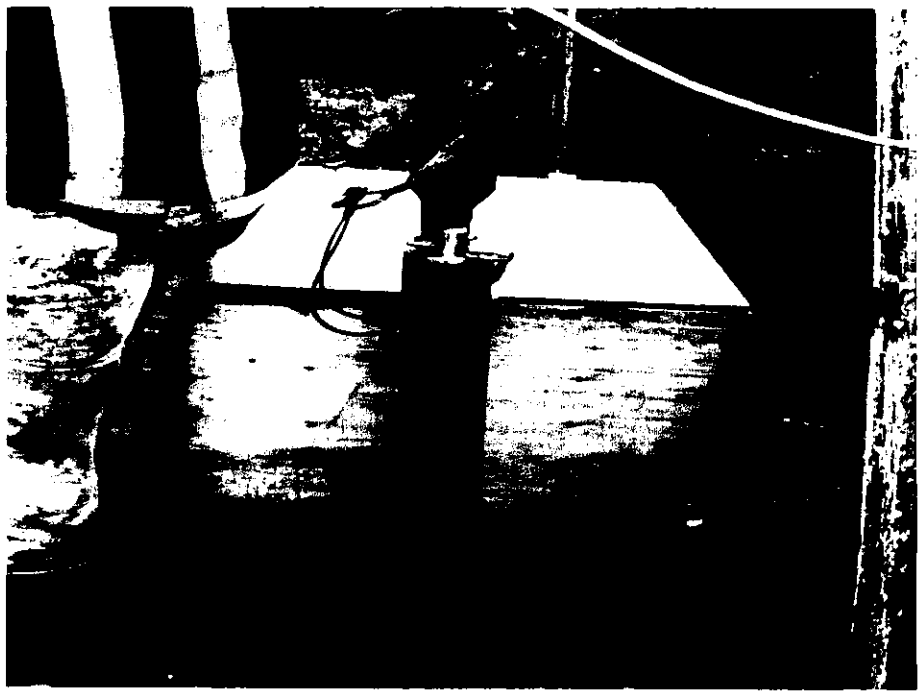
Air Compressor – The air compressor is located inside the air compressor building. The horizontal air compressor (DeVair Systems Model TAP-5562-03XL Duplex Compressor Package, 5 horsepower, 120-gallon receiver) provides the five (5) pneumatic pumps with compressed air. The air compressor operating manual is provided in Appendix H.



Refrigerated Air Dryer – The refrigerated air dryer is located inside the OWS building directly beside the transfer tank. The refrigerated air dryer is a constantly running, non-cycling dryer with a hermetic type refrigeration compressor. Air from the compressor is transferred from the refrigerated air dryer to the pneumatic pumps inside the selected pumping wells. The operating manual is provided in Appendix I.



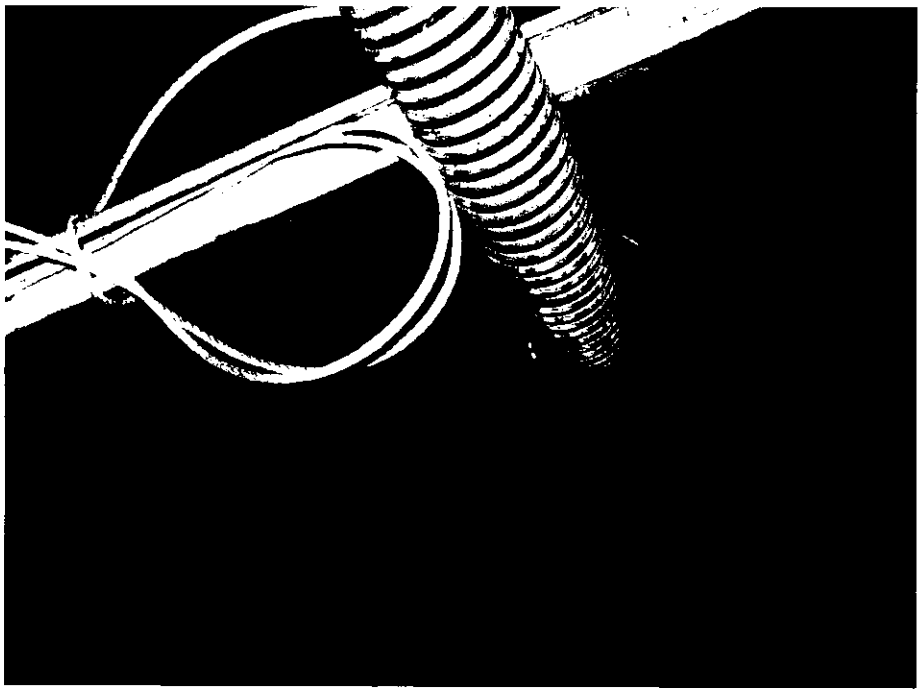
Pneumatic Pumps – Five (5) pneumatic pumps are used to collect total fluids from selected pumping wells. The pneumatic pumps are QED AP-4 Top-Loading Auto Pumps. The AP-4 Auto Pump manual is provided in Appendix J.



Pumping Well Network – The pumping well network consists of nine (9) pumping wells and is located between Little Jackfish River and Lagoon No.2. All nine (9) pumping wells are monitored on a monthly basis to ensure that the pneumatic pumps are located in the proper pumping wells with respect to LNAPL thickness and collection.

Bentonite / Cement Cut-Off Wall – The underground bentonite / cement cut-off wall is located adjacent the Little Jackfish River (Figure 6). The cut-off wall is in place to prevent LNAPL from entering the Little Jackfish River via groundwater seepage. Historical records show the dimensions of the wall to be between 0.6 and 1.1 m in width, with a total length of 78.5 m.

Interception Trench Collection Sump – The interception trench and sump provide hydraulic control in the former Pump House area. The submersible pump transfers total fluids from the Interception Trench to the OWS, located in the pollution control building. A manual for the Monarch Industries, WS Series, ½ horsepower Submersible Effluent and Sewage Pump is provided in Appendix K.





3.3 OPERATION AND MAINTENANCE

3.3.1 Inspections

The Lagoon No.2 LNAPL CS is inspected weekly by local personnel and on a monthly basis by KGS Group throughout the operating year (May to November). Operation of the CS is recorded on an abbreviated inspection form for weekly inspections and a more detailed inspection form during monthly system inspections. Both inspection forms can be found in Appendix B and Appendix D, respectively.

3.3.2 Operation and Maintenance Schedule

The following sections provide a synopsis of the operation and maintenance inspection schedule. All activities related to system performance and maintenance activities are documented and included in Monthly Environmental Status Reports and the Annual Report provided to CN.

Weekly

Throughout the operating year, local personnel perform an abbreviated weekly inspection. During weekly inspections, local personnel conduct the following duties:

- Inspect the operation of each pneumatic pump,
- Monitor lines and tanks for any signs of leaks,
- Drain the supply lines of the refrigerated air dryer and the air compressor tank,
- Monitor LNAPL and water level measurements in the horizontal waste oil tank, and
- Record visual observations with respect to LNAPL / PHC sheen in Lagoon No.2 and the Little Jackfish River.

The CN Environmental Officer is contacted immediately by KGS Group personnel if LNAPL / PHC sheen is present in the Little Jackfish River or if monthly laboratory effluent results exceed the applicable MOE C of A criteria.

Weekly abbreviated inspection forms are completed by local personnel and sent via email to KGS Group for review. The originals are kept on-site.

Monthly

Throughout the operating year KGS Group personnel perform monthly detailed inspections. During monthly inspections, KGS Group personnel conduct the following duties:

- All system components are inspected and tested. The system components include the OWS, transfer tank, horizontal waste oil tank, air compressor and refrigerated air dryer,
- Fluid from the air compressor is manually drained,
- Monitor all lines and tanks for any signs of leaks,
- LNAPL and water levels are monitored at the interception trench collection sump, waste oil tank, selected monitoring wells (MW-21, OW5-4, OW5-2) and pumping wells (PW-2 to PW-10),
- Manually bail any LNAPL which is present within the monitoring well network and place into the waste oil tank,
- Record visual observations with respect to LNAPL / PHC sheen in Lagoon No.2 and Little Jackfish River, and
- Procure monthly effluent samples from the Lagoon No.2 discharge to the Little Jackfish River (HOR-002-05).



- Remove the data logger, located within Lagoon No.2, and download the collected effluent flow data from the data logger. The calibration of the data logger and monthly flow data is conducted on a monthly basis.

The CN Environmental Officer is contacted immediately by KGS Group if LNAPL / PHC sheen is present in the Little Jackfish River or if monthly laboratory effluent results exceed the applicable MOE C of A criteria.

Monthly inspection forms are completed by KGS Group personnel. Duplicate copies are made for KGS Group's records and the original copies are kept on site.

System Maintenance

Maintenance of the Lagoon No.2 LNAPL CS components is conducted on an as required basis throughout the operating year.

3.4 EFFLUENT FLOW MONITORING AND SAMPLING

3.4.1 Effluent Flow Monitoring

At the beginning of each operating year, a transducer is installed in Lagoon No.2 to measure and record the height of the water column in order to calculate the effluent flow rate from Lagoon No.2. The transducer is installed in the northeast corner of Lagoon No.2, up gradient of the final effluent discharge point to the Little Jackfish River (Figure 7).

The data logger is placed within a protective "pipe and block" assembly to ensure that the data logger remains protected, and that the data logger maintains its vertical position for accurate measurement of water depth. A continuous monitoring barometric pressure logger, installed in the west end of the Yard in conjunction with the data logger, calibrates the water depth measurements, which are impacted by changes in atmospheric pressure. The data loggers are pre-set to obtain water depth readings on an hourly basis. Data from each logger is manually downloaded on a monthly basis to ensure that the loggers continue to function as required, and to minimize data loss due to equipment malfunction or other issues. Pressure transducer theory and calculations are provided in Appendix M.

3.4.2 Effluent Flow Sampling

Effluent samples are collected on a monthly basis throughout the operating year from the Lagoon No.2 final discharge (HOR-002-05) to Little Jackfish River. Throughout the operating year (spring, summer, fall), additional surface water samples are procured throughout the Yard at various discharge points to the Little Jackfish River.

Bottles are placed in cooler chests with ice and submitted to Maxxam Analytics Inc., an accredited analytical testing facility, in Mississauga, Ontario. Each sample is analyzed for BTEX, TPH, TEH, MOG, TOG, MTBE, pH, lead, alkalinity, and hardness. Laboratory analyses are reviewed and compared to the applicable MOE C of A criteria. Laboratory data is recorded and presented in both Monthly and Annual Performance Reports to CN. In the event of a laboratory result exceeding the applicable MOE C of A criteria, or if PHC sheen is observed in the Little Jackfish River, the CN Environmental Officer is immediately notified of the result.

4.0 FORMER SHOP TRACK DIESEL RECOVERY SYSTEM

4.1 INTRODUCTION

Construction of the Shop Track Diesel Recovery System (DRS) commenced in 2003 and was completed in 2004. The Shop Track DRS was designed and constructed as part of the Phase IV Remedial Action Plan implemented by CN to address environmental concerns with respect to PHC contamination identified within the former Shop Track fuelling area in the east end of the Yard. The Shop Track DRS was designed to collect and recover the PHC underlying the former Shop Track fuelling area in the east end of the Yard with minimal operation and maintenance requirements. Figure 8 shows the location of the Shop Track DRS in relation to the Yard location plan.

4.2 SYSTEM OPERATION

4.2.1 System Overview

The Shop Track DRS is composed of a collection sump, a submersible pump, a skimmer unit, and 4,540 L waste oil recovery tank. Total fluids from the surrounding area drain by gravity through open slats cut into the existing collection sump. The skimmer unit, which is located within the skimmer building, collects LNAPL floating on the surface of the water within the existing collection sump. Collected LNAPL is transferred by gravity to the 4,540 L waste oil recovery tank. When fluid levels within the collection sump drop to a level where the skimmer belt can no longer collect floating LNAPL on the surface of the water, then the submersible pump, complete with stop and start floats, is activated to transfer total fluids from the collection sump to the oil / water separator, located at the Waste Transfer Facility.

4.2.2 System Components

The Shop Track DRS contains system components both inside and outside the skimmer building and are listed below. The locations of the system components are shown on Figure 9, and a schematic diagram of the system is presented on Figure 10.

Collection Sump – The collection sump is located in the skimmer building. The collection sump is a 1000mm diameter, slotted corrugated steel metal pipe and has been installed with open slats to allow for total fluids to drain by gravity into the collection sump.



Skimmer Unit – The Abanaki Oil Grabber Model 8 Oil Skimmer unit is located in the skimmer building. The skimmer unit consists of a hydrophobic skimmer belt, yolk and cage assembly and decanter unit. The skimmer belt is suspended within a 1000mm diameter, slotted corrugated metal pipe, which allows PHC and water to enter. LNAPL floating on the surface of the fluids within the collection sump is collected by the hydrophobic skimmer belt and discharged to the decanter unit. Recovered LNAPL drains by gravity from with the decanter unit to the waste oil recovery tank, while any water collected, drains back to the collection sump. The Abanaki Oil Grabber Model 8 Oil Skimmer Manual is provided in Appendix F.

Waste Oil Tank – The 4,540 L double walled waste oil recovery tank is located outside adjacent to the skimmer building. The waste oil recovery tank is equipped with an overfill sensor, which is connected to the skimmer unit, and automatically disables the operation of the skimmer unit when the waste oil recovery tank is full. Operation of the skimmer unit can only resume after the waste oil recovery tank has been emptied.



Submersible Pump – The submersible pump installed within the collection sump provides hydraulic control in the former Shop Track area. The submersible pump transfers total fluids from the collection sump to the OWS, located within the Waste Transfer Facility building. A manual for the Myers, WHRS Series, ½ horsepower Submersible Effluent and Sewage Pump is provided in Appendix L.

4.3 OPERATION AND MAINTENANCE

4.3.1 Inspections

The Shop Track DRS is inspected weekly by local personnel and on a monthly basis by KGS Group throughout the operating year (May to November). Operation of the DRS is recorded on an abbreviated inspection form for weekly inspections and a more detailed inspection form during monthly system inspections. Both inspection forms can be found in Appendix B and Appendix E, respectively.

4.3.2 Operation and Maintenance Schedule

The following sections provide a synopsis of the operation and maintenance inspection schedule. All activities related to system performance and maintenance activities are documented and included in Monthly Environmental Status Reports and the Annual Report provided to CN.

Weekly

Throughout the operating year, local personnel perform an abbreviated weekly inspection. During weekly inspections, local personnel conduct the following duties:

- Inspect the operation of the skimmer unit and perform skimmer unit maintenance,
- Monitor lines and tanks for any signs of leaks, and
- Monitor LNAPL and water level measurements in the waste oil recovery tank.

Weekly abbreviated inspection forms are completed by local personnel and sent via email to KGS Group for review. The originals are kept on-site.

Monthly

Throughout the operating year, KGS Group personnel perform monthly detailed inspections. During monthly inspections, KGS Group personnel conduct the following duties:

- All Shop Track DRS components are inspected and tested. The Shop Track DRS components include the collection sump, submersible pump, skimmer unit, and waste oil recovery tank,
- Collected water in the skimmer unit decanter drains by gravity to the collection sump and maintenance is completed on all skimmer unit components (skimmer blades, collection chamber, decanter),
- Monitor all lines and tanks for any signs of leaks,
- LNAPL and water levels are monitored in the collection sump, waste oil recovery tank, and monitoring wells (MW-126 and OW3-2), and
- Manually bail any LNAPL which is present within the monitoring well network and place into the waste oil recovery tank.

Monthly inspection forms are completed by KGS Group personnel. Duplicate copies are made for KGS Group's records and the original copies are kept on site.

System Maintenance

Maintenance of the Shop Track DRS components is conducted on an as required basis throughout the operating year.

4.4 SURFACE WATER / EFFLUENT SAMPLING

Water collected by the skimmer belt from the fluid surface within the collection sump is returned to the collection sump; therefore, effluent does not discharge from this DRS. When levels dictate, total fluids are pumped to the OWS, located at the Waste Transfer Facility. Processed effluent from the OWS drains by gravity to Lagoon No.2. Lagoon No.2 effluent is sampled on a monthly basis during the operating year as part of the Lagoon No.2 CS.

5.0 WASTE TRANSFER FACILITY

5.1 INTRODUCTION

Total fluids, collected from the Yard via operations conducted by KGS Group, local CN forces and other contractors, are placed in a 10,000 gallon holding tank. The purpose of the WTF system is to separate the total fluids stored in the holding tank. Figure 11 shows the location of the WTF in relation to the Yard location plan.

5.2 SYSTEM OPERATION

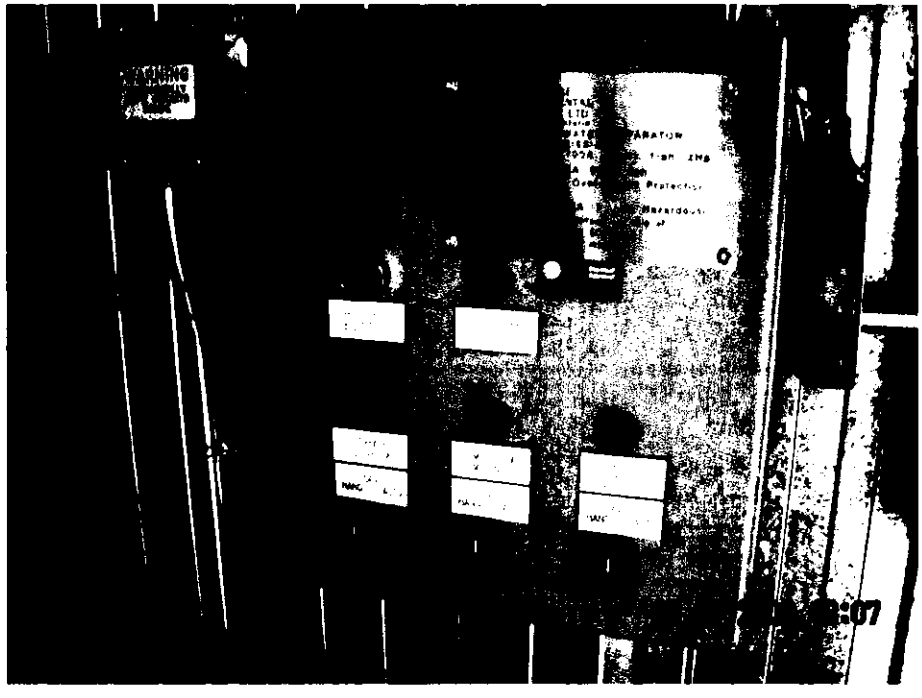
5.2.1 System Overview

Total fluids drain by gravity from the holding tank to the coalescing OWS, located inside the WTF building. The total fluids are processed through the OWS. Collected LNAPL is pumped to an external tanker car, provided by CN. Effluent water from the OWS drains by gravity and discharges to Lagoon No.2.

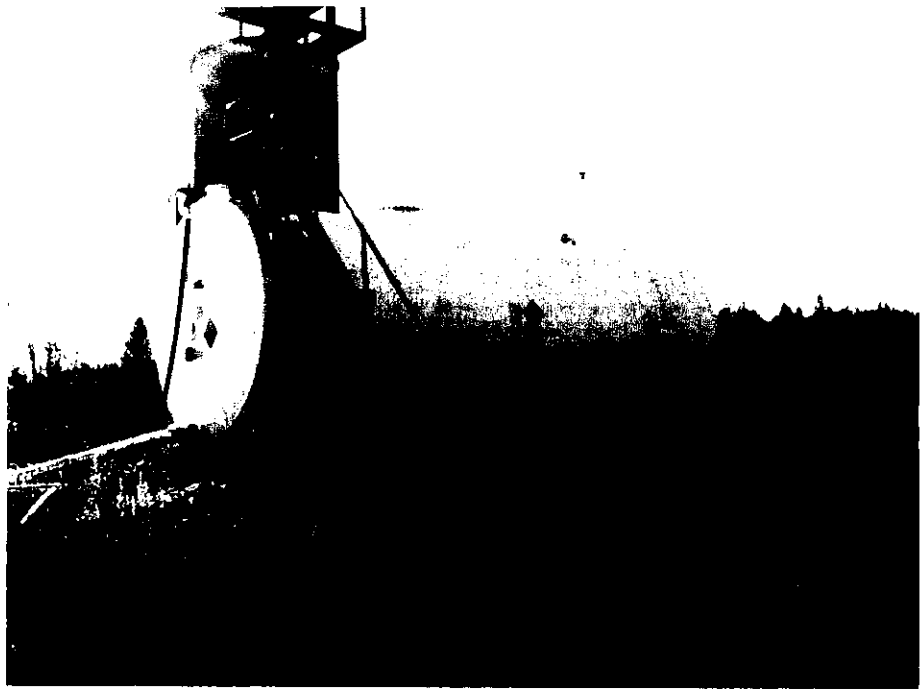
5.2.2 System Components

The WTF contains system components both inside and outside the building and are listed below. The locations of the system components are shown on Figure 12, and a schematic diagram of the system is presented on Figure 10. The WTF consists of a control panel, holding tank, coalescing OWS, LNAPL transfer pump, CN tanker car, former fuelling stand sump pit, and submersible pump.

Control Panel – The control panel contains the motor controls, switches, and relays. The control panel monitors and controls all of the system operation.



Holding Tank – The holding tank is a 10,000 gallon Westeel above ground waste oil storage tank, Model FV-500. The holding tank is used to store all collected fluids (LNAPL and water) via Yard operations. Fluids drain by gravity to the OWS or can be transferred to the OWS via an electrically actuated ball valve.

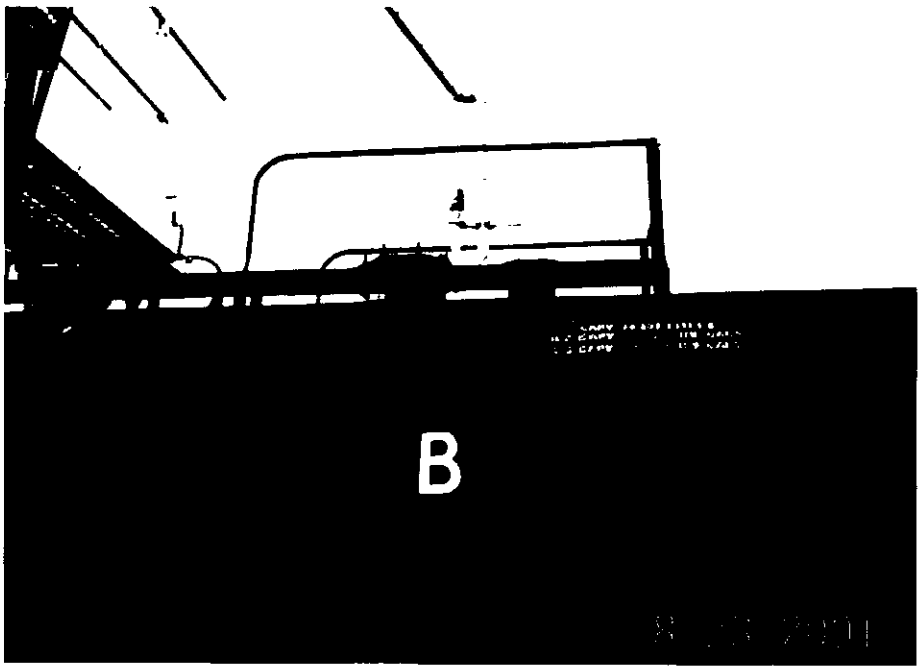


Oil / Water Separator – Total fluids enter the OWS and flows slowly through the coalescing packs. These packs aid in the removal of LNAPL from the water and also, encourage LNAPL to float, ultimately forming a layer on the water surface. LNAPL is removed from the water surface with an adjustable skimmer and is discharged to an internal storage tank. Once the internal storage tank is full, LNAPL is pumped through the LNAPL transfer pump, via a loading arm to the CN tanker car. Processed water flows under a weir and into the discharge section of the OWS. The water in the discharge section drains by gravity to the discharge line, and ultimately, to Lagoon No.2.

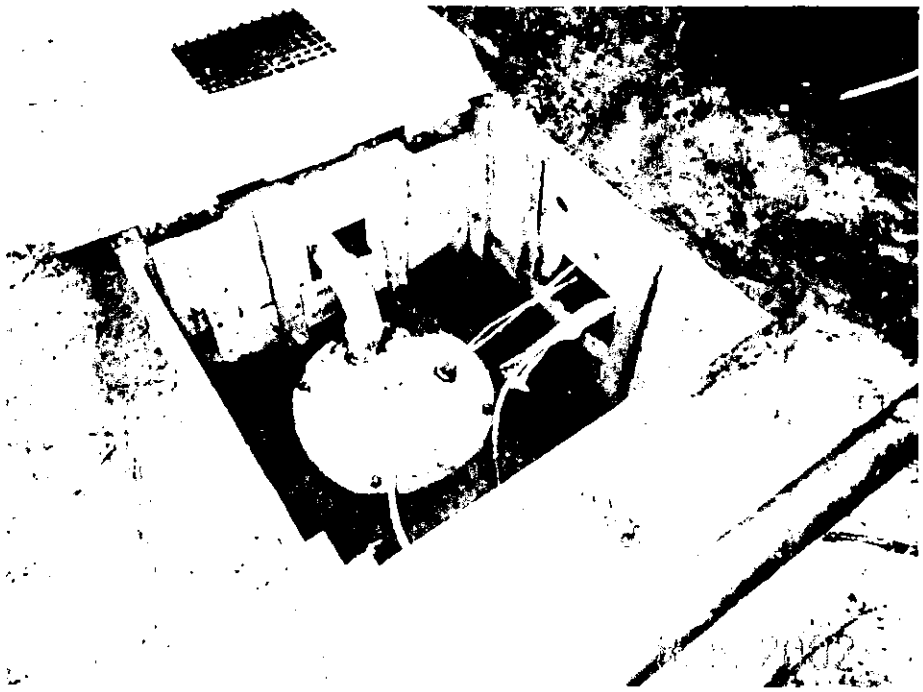
LNAPL Transfer Pump – Level switches in the OWS internal storage tank controls the operation of the LNAPL transfer pump. These level switches work in conjunction with level switches installed in the CN tanker car to automatically shut down the system when the CN tanker car is filled to capacity.



CN Tanker Car – The CN tanker car is used for the final collection point for LNAPL after total fluids have been processed through the WTF.



Fuelling Stand Sump Pit – The former fuelling stand sump pit, located adjacent to the WTF building, is used to collect any total fluids from the surrounding area and any possible LNAPL spillage from Yard operations. Discharge lines from the sump pit are connected to a submersible pump, which transfers total fluids to the OWS to be processed.



5.3 OPERATIONS AND MAINTENANCE

5.3.1 Inspections

The WTF is inspected weekly by local personnel and on a monthly basis by KGS Group throughout the operating year (May to November). Operation of the WTF is recorded on an abbreviated inspection form for weekly inspections and a more detailed inspection form during monthly system inspections. Both inspection forms can be found in Appendix B and Appendix E, respectively.

5.3.2 Operating and Maintenance Schedule

The following sections provide a synopsis of the operation and maintenance inspection schedule. All activities regarding system performance and maintenance activities are documented and included in Monthly Environmental Status Reports and the Annual Report provided to CN.

Weekly

Throughout the operating year, local personnel perform an abbreviated weekly inspection. During weekly inspections, local personnel conduct the following duties:

- Inspect the operation of the system components and perform any required system maintenance,
- Monitor lines and tanks for any signs of leaks, and
- Monitor LNAPL and water level measurements in the waste oil holding tank and CN tanker car.

Weekly abbreviated inspection forms are completed by local personnel and sent via email to KGS Group for review. The originals are kept on-site.

Monthly

Throughout the operating year, KGS Group personnel perform monthly detailed inspections. During monthly inspections, KGS Group personnel conduct the following duties:

- All WTF system components are inspected and tested. The WTF system components include the OWS, LNAPL transfer pump, submersible pump, loading arm, holding tank, and former fuelling stand sump pit,
- Monitor all lines and tanks for any signs of leaks, and
- LNAPL and water levels are monitored in the waste oil holding tank, CN tanker car, and OWS.

Monthly inspection forms are completed by KGS Group personnel. Duplicate copies are made for KGS Group's records and the original copies are kept on site.

System Maintenance

Maintenance of the WTF system components is conducted on an as required basis throughout the operating year.

5.4 SURFACE WATER / EFFLUENT SAMPLING

Processed effluent from the OWS drains by gravity to Lagoon No.2. Lagoon No.2 effluent is sampled on a monthly basis during the operating year as part of the Lagoon No.2 CS.

6.0 REPORTING

Detailed field notes and laboratory data are summarized and discussed in Monthly Environmental Status Reports provided to CN. Monthly reports contain at a minimum, a brief synopsis of the operation and maintenance, LNAPL recovery and effluent monitoring results. The information provided in each Monthly Environmental Status Report is also presented with greater detail in the Annual Environmental Status Report provided to CN.

7.0 SPILL RESPONSE PLAN

In the event of a public complaint or if an abnormal laboratory result is received, KGS Group's procedure is to contact CN Environmental Officer Mr. Aaron Stadnyk directly. Mr. Stadnyk will direct KGS Group personnel with the appropriate course of action.

The CN Emergency Response Plan is provided as Appendix A.

8.0 HEALTH AND SAFETY PLAN

All KGS Group employees and local personnel have been trained as per the CN eRailSafe safety guidelines, which is a mandatory requirement required for all site personnel entering a CN property. KGS Group will ensure that any sub-contractors, under the direct supervision of KGS Group, will obtain their CN eRailSafe badges and be trained as per the CN eRailSafe safety guidelines prior to entering any CN property.

The following sections list the minimum safety standards that all site personnel must abide by prior to entering a CN property. All CN and non-CN personnel must follow the requirements listed in the CN Emergency Response and Health and Safety Plan (Appendix A).

8.1 GENERAL

- KGS Group personnel will take all steps necessary to ensure protection of employees, CN operations, property and the public.
- Workers will immediately abide by instructions from CN personnel.
- KGS Group personnel shall be responsible for the implementation of the safety standards and the co-ordination of work crews under their supervision on site.
- Before the commencement of work, all documentation will be properly executed and available for review by CN personnel.
- Periodic briefings will be held to review the safety guidelines and site conditions.

8.2 OPERATION SAFETY

As per the CN Health and Safety Plan (Appendix A), all CN and non-CN workers must abide by the following:

- Work shall not be performed within (8) meters (25 feet) of the nearest rail without track protection unless explicitly permitted by CN.
- Equipment operating within (8) meters (25 feet) of the nearest rail must come to complete stop prior to the passage of trains or rail equipment
- Vehicles and equipment will not be parked closer than (5) meters (15 feet) from the nearest rail unless explicitly permitted by CN.
- Upon the passage of a train, no one shall stand closer than (5) meters (15 feet) from any switch stand unless explicitly permitted by CN.

- No one shall crawl under, climb over or pass between standing rail equipment.
- No one shall cross a track within (8) meters (25 feet) of standing rail equipment.
- Drilling or excavation will not take place until all utility and communication lines are located.
- No one shall tamper with, modify or remove CN plant, signals, structures, equipment or other property.

8.3 PERSONAL PROTECTIVE EQUIPMENT

All personnel shall wear the following CN approved personal protective equipment (PPE):

- Hard Hat
- Safety Glasses
- Reflective Vests (360°)
- CSA-1 Steel Toed Work Boots

8.4 PROHIBITIONS

The following is prohibited:

- Use, possession, distribution or trafficking of alcohol, drugs or drug paraphernalia is not permitted when on CN business or property.
- Firearms are not permitted on CN property without written approval from the Chief of CN Police and all pertinent government permits.
- Explosives are not permitted on CN property without written CN approval.
- No employee shall engage in horseplay, practical jokes, fighting or any other activity that may create a hazard.

FIGURES

FileName: P:\Projects\2014\14-0434-005\dwg\en\14-0434-005_FIG 1-Rev 0.dwg - Tab: FIG 01 Plotted By: twilliamson 12/08/2014 [Mon 9:37am]
24"x36" PLOT SCALE: 1:1
11"x17" PLOT SCALE: 2

TOWN OF HORNEPAYNE

NOTES:

1. LOCATION OF INSET-PLAN IN RELATION TO COORDIATES IS APPROXIMATE

REFERENCE:

BASE MAP: 1:50,000 NTS MAP 42 F/2 (HORNEPAYNE), NAD 1927, EDITION 2, PUBLISHED 1979

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CN HORNEPAYNE YARD OPERATIONS MANUAL – CERTIFICATE OF APPROVAL No. 3528-83LQWT.

SITE LOCATION PLAN

DECEMBER 2014 | FIGURE 1 | REV. 0

0000059

000061

24X36

660000 E

661000 E

662000 E

663000 E

5456000 N

5455000 N

5454000 N

DIESEL RECOVERY SYSTEM
FUELLING STAND AREA

WEST END

EAST END

LITTLE JACKFISH RIVER

LEGEND

PLAN LIMITS

DIESEL RECOVERY SYSTEM DETAIL PLANS

RIVER FLOW DIRECTION

0 100 200 300 400 500m

SCALE: 1:5000 METRIC 24"x36"
1:10000 METRIC 11"x17"

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A	14/05/21	ISSUED WITH DRAFT OPERATIONS MANUAL	TG

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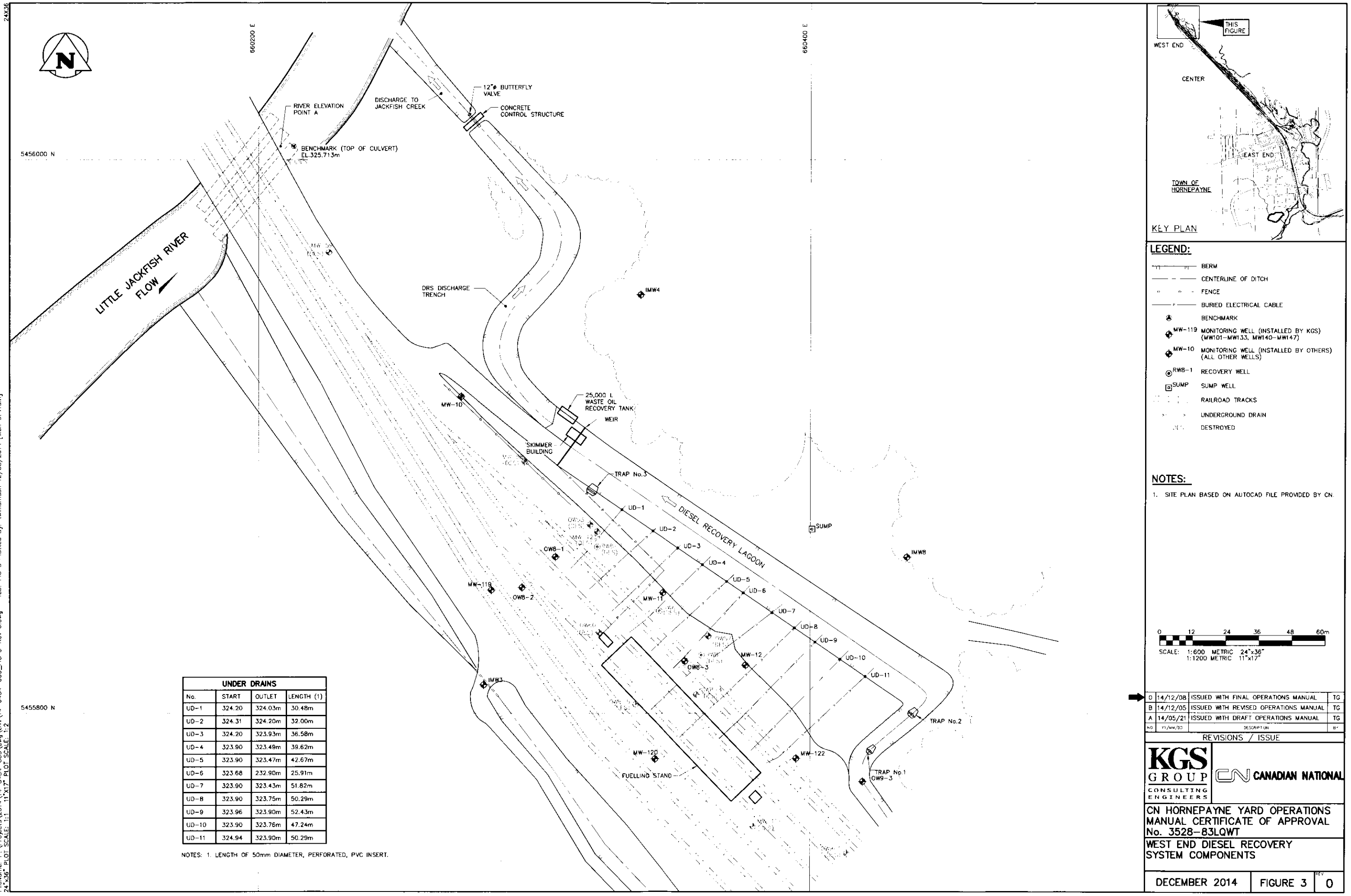
CN HORNEPAYNE YARD OPERATIONS MANUAL – CERTIFICATE OF APPROVAL No. 3528-83LQWT.

YARD LOCATION PLAN – WEST END

DECEMBER 2014 | FIGURE 2 | REV. 0

FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 2-Rev 0.dwg – Tab: FIG 2 Plotted By: twilliamson 12/08/2014 [Mon 9:39am]
24"x36" PLOT SCALE: 1:1 11"x17" PLOT SCALE: 1:2

000063



UNDER DRAINS			
No.	START	OUTLET	LENGTH (1)
UD-1	324.20	324.03m	30.48m
UD-2	324.31	324.20m	32.00m
UD-3	324.20	323.93m	36.58m
UD-4	323.90	323.49m	39.62m
UD-5	323.90	323.47m	42.67m
UD-6	323.68	232.90m	25.91m
UD-7	323.90	323.43m	51.82m
UD-8	323.90	323.75m	50.29m
UD-9	323.96	323.90m	52.43m
UD-10	323.90	323.76m	47.24m
UD-11	324.94	323.90m	50.29m

NOTES: 1. LENGTH OF 50mm DIAMETER, PERFORATED, PVC INSERT.

LEGEND:

- BERM
- CENTERLINE OF DITCH
- FENCE
- BURIED ELECTRICAL CABLE
- BENCHMARK
- MW-119 MONITORING WELL (INSTALLED BY KGS) (MW101-MW133, MW140-MW147)
- MW-10 MONITORING WELL (INSTALLED BY OTHERS) (ALL OTHER WELLS)
- RWB-1 RECOVERY WELL
- SUMP SUMP WELL
- RAILROAD TRACKS
- UNDERGROUND DRAIN
- DESTROYED

NOTES:

1. SITE PLAN BASED ON AUTOCAD FILE PROVIDED BY CN.

0 12 24 36 48 60m

SCALE: 1:600 METRIC 24"x36"
1:1200 METRIC 11"x17"

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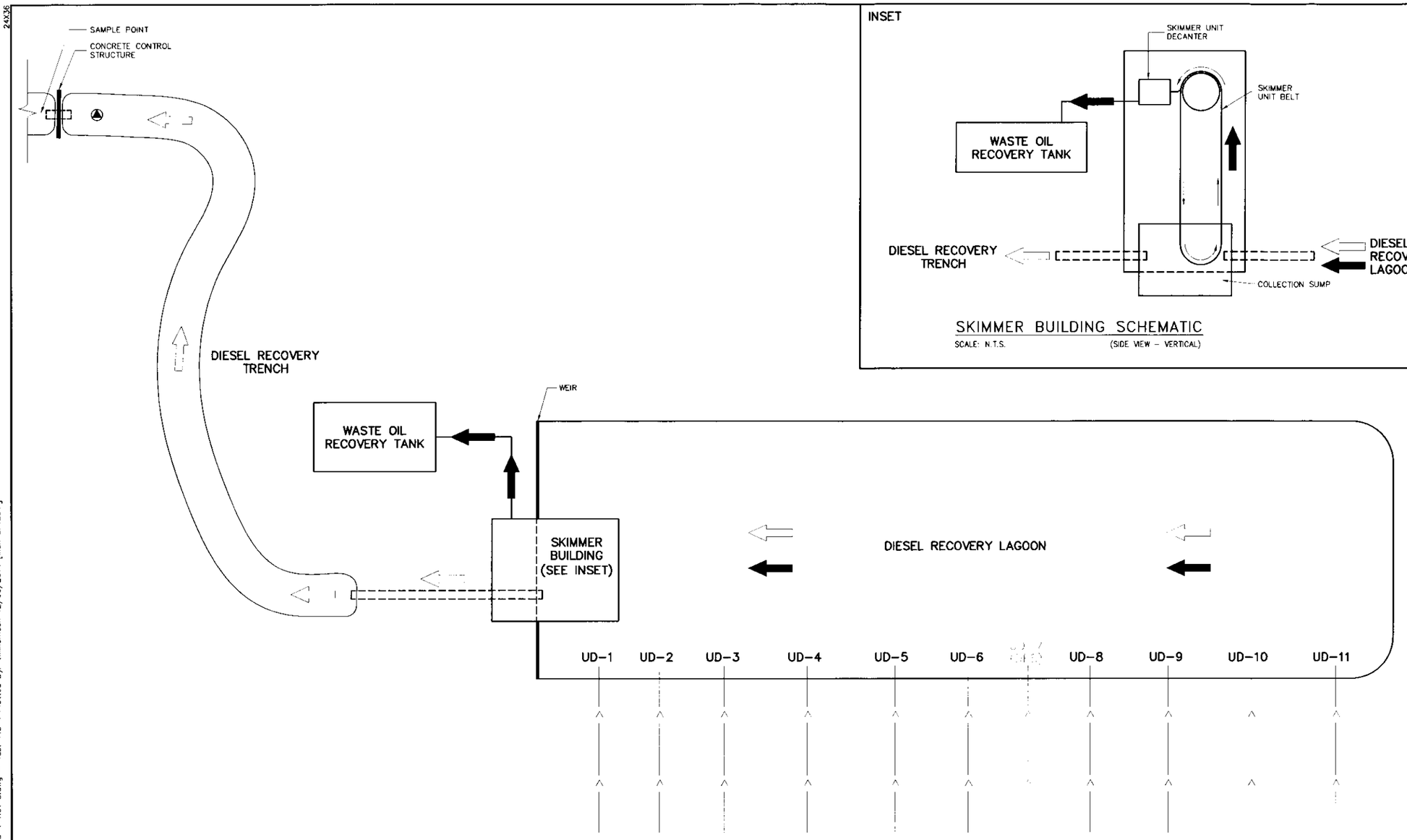
CN HORNEPAYNE YARD OPERATIONS MANUAL CERTIFICATE OF APPROVAL No. 3528-83LQWT

WEST END DIESEL RECOVERY SYSTEM COMPONENTS

DECEMBER 2014 | FIGURE 3 | REV 0

FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 3-Rev 0.dwg - Tab: FIG 3 Plotted By: twilliamson 12/08/2014 [Mon 9:41am]
24"x36" PLOT SCALE: 1:1 11"x17" PLOT SCALE: 1:2

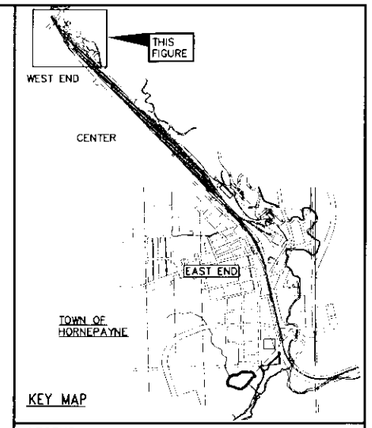
24X36



WEST END DIESEL
RECOVERY SYSTEM SCHEMATIC
SCALE: N.T.S. (TOP VIEW)

INSET

SKIMMER BUILDING SCHEMATIC
SCALE: N.T.S. (SIDE VIEW – VERTICAL)



LEGEND:

- WATER FLOW
- LNAPL FLOW
- UNDERGROUND DRAIN WITH FLOW DIRECTION
- RAILROAD TRACKS
- UNDERGROUND PIPE
- HIDDEN OBJECTS
- LOCATION OF FLOW DATA LOGGER

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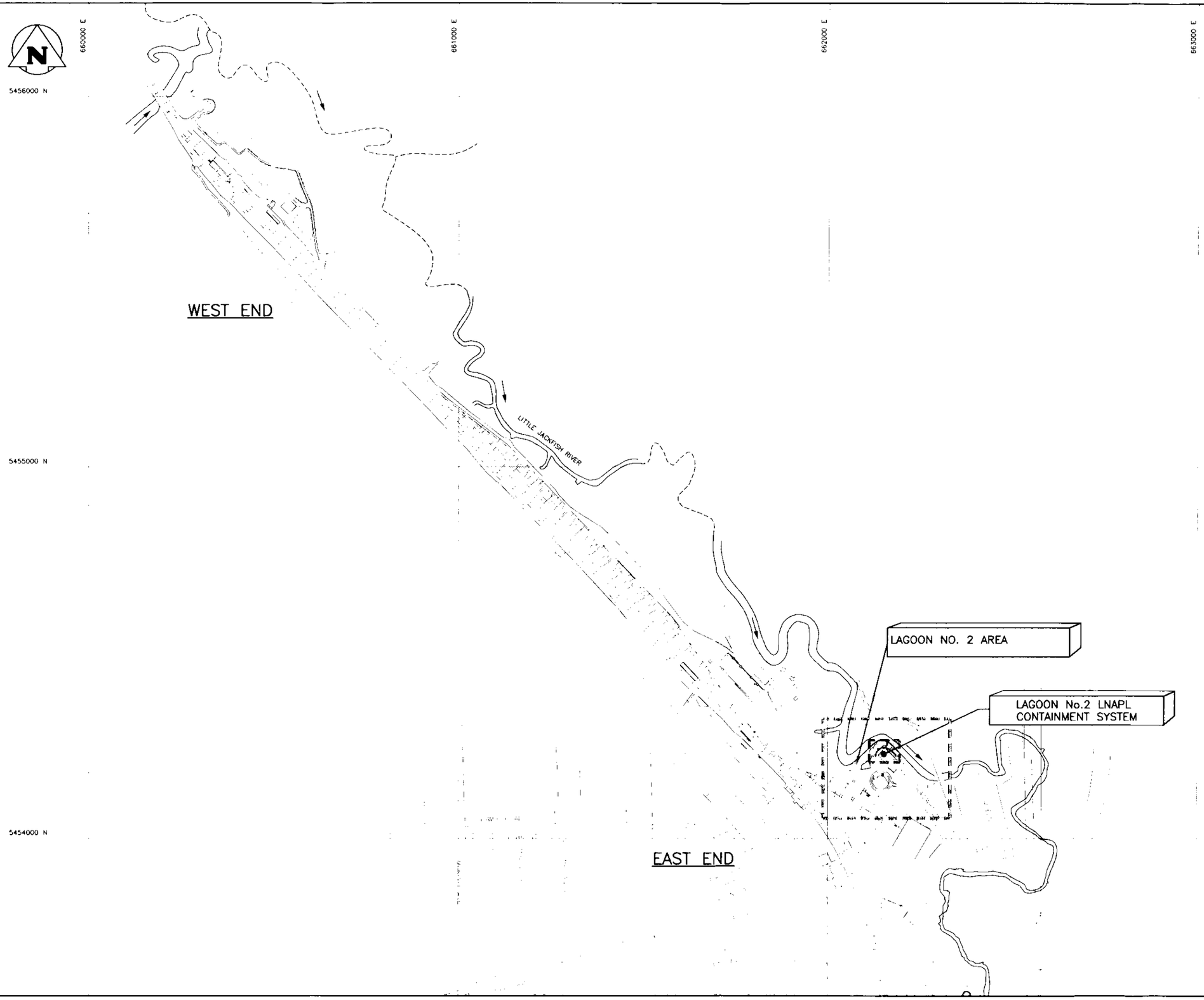
CN HORNEPAYNE YARD OPERATIONS MANUAL – CERTIFICATE OF APPROVAL No. 3528-83LQWT.

WEST END DIESEL RECOVERY SYSTEM SCHEMATIC

DECEMBER 2014 | FIGURE 4 | REV 0

FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 4-Rev 0.dwg – Tab: FIG 4 Plotted By: twilliamson 12/08/2014 [Mon 9:42am]
24"x36" PLOT SCALE: 1:1 11"X17" PLOT SCALE: 1:2

000065



LEGEND

- PLAN LIMITS
- DIESEL RECOVERY SYSTEM DETAIL PLANS

0 100 200 300 400 500m

SCALE: 1:5000 METRIC 24"x36"
1:10000 METRIC 11"x17"

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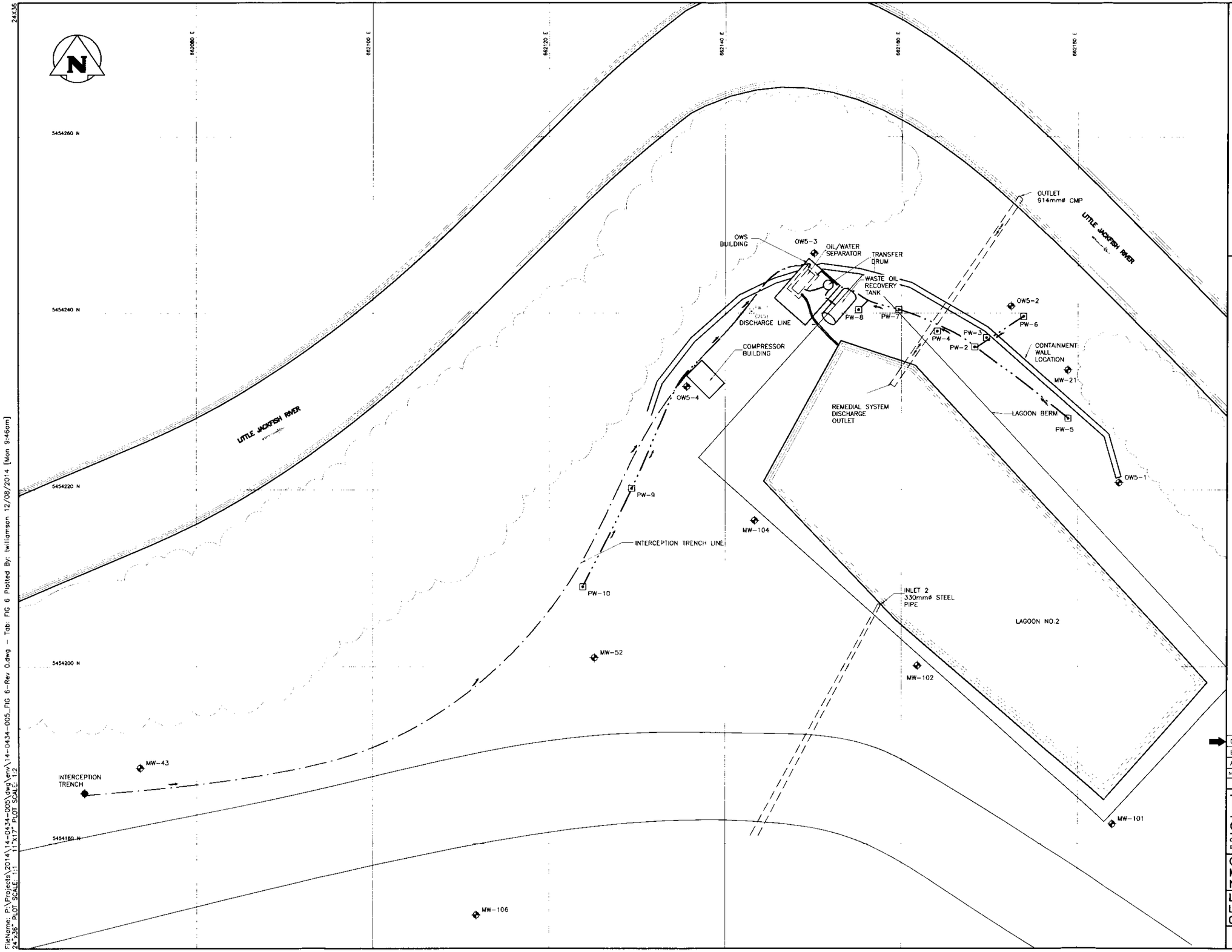
YARD LOCATION PLAN – LAGOON No. 2 AREA

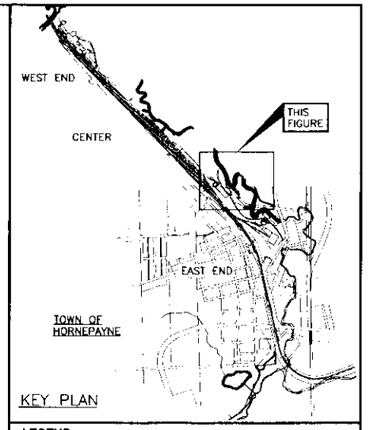
DECEMBER 2014 | FIGURE 5 | 0

FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 5-Rev 0.dwg - Tab: FIG 5 Plotted By: twilliamson 12/08/2014 [Mon 10:01am]
24"x36" PLOT SCALE: 1:1 11"x17" PLOT SCALE: 1:2

690000

24X36





LEGEND

- APPROXIMATED LIMITS OF TREED AREA
- EDGE OF WATER
- CULVERT
- DISCHARGE LINE
- INTERCEPTION TRENCH LINE
- MW-117 MONITORING WELL (INSTALLED BY KGS) (MW101-MW133, MW140-MW147)
- OW5-4 MONITORING WELL (INSTALLED BY OTHERS) (ALL OTHER WELLS)
- INTERCEPTION TRENCH
- PW-9 PUMPING WELL
- TOTAL FLUIDS FLOW DIRECTION
- LPH FLOW DIRECTION
- WATER FLOW DIRECTION
- SURFACE WATER FLOW DIRECTION
- DESTROYED

NOTES:

1. DRAWING BASED ON BIOGENIE ENVIRONMENTAL CN AUTO CAD FILE.

0 4 8 12 16 20m

SCALE: 1:200 METRIC 24"x36"
1:400 METRIC 11"x17"

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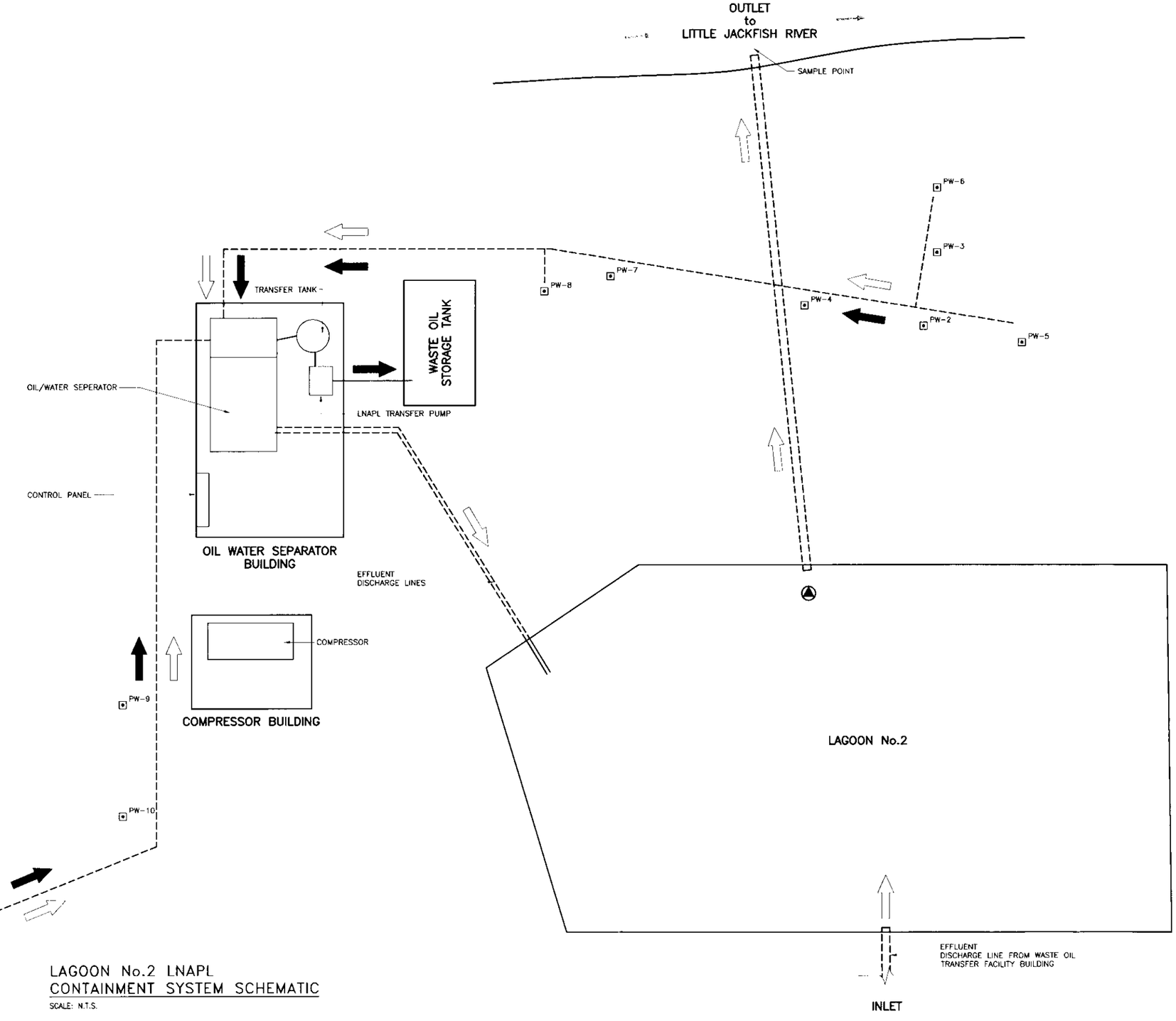
CN HORNEPAYNE YARD OPERATIONS MANUAL – CERTIFICATE OF APPROVAL No. 3528-83LQWT

LAGOON No.2
LNAPL CONTAINMENT SYSTEM COMPONENTS

DECEMBER 2014 | FIGURE 6 | REV 0

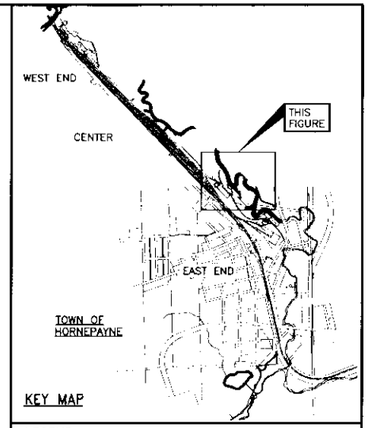
FileName: P:\Projects\2014\14-0434-005\dwg\en\14-0434-005_FIG 6-Rev 0.dwg – Tab: FIG 6 Plotted By: twilliamson 12/08/2014 [Mon 9:46am]
24"x36" PLOT SCALE: 1:1 11"x17" PLOT SCALE: 1:2

24X36



LAGOON No.2 LNAPL
CONTAINMENT SYSTEM SCHEMATIC

SCALE: N.T.S.



KEY MAP

LEGEND:

- WATER FLOW
- LNAPL FLOW
- RAILROAD TRACKS
- UNDERGROUND PIPE
- HIDDEN OBJECTS
- RIVER WATER FLOW DIRECTION
- PW-1 PUMPING WELL
- FLOW DATA LOGGER

NO	YY/MM/DD	DESCRIPTION	BY
0	14/12/08	ISSUED WITH FINAL OPERATIONS MANUAL	TG
B	14/12/05	ISSUED WITH REVISED OPERATIONS MANUAL	TG
A	14/05/21	ISSUED WITH DRAFT OPERATIONS MANUAL	TG

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LAGOON No.2
LNAPL CONTAINMENT SYSTEM SCHEMATIC

DECEMBER 2014 | FIGURE 7 | REV 0

000071

FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 7-Rev 0.dwg — Tab: FIG 7 Plotted By: twilliamson 12/08/2014 [Mon 9:47am]
24"x36" PLOT SCALE: 1:1 11"x17" PLOT SCALE: 1:2

24X36

N

660000 E

661000 E

662000 E

663000 E

5456000 N

5455000 N

5454000 N

WEST END

LITTLE JACKFISH RIVER

DIESEL RECOVERY SYSTEM
FORMER SHOP TRACK FUELLING AREA/
WASTE OIL TRANSFER FACILITY

EAST END

LEGEND

DIESEL RECOVERY SYSTEM DETAIL PLANS

0 100 200 300 400 500m

SCALE: 1:5000 METRIC 24"x36"
1:10000 METRIC 11"x17"

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0	14/12/08	ISSUED WITH FINAL OPERATIONS MANUAL	TG
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YARD LOCATION PLAN – SHOP TRACK AREA

DECEMBER 2014 | FIGURE 8 | REV. 0

FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 8-Rev 0.dwg - Tab: FIG 8 Plotted By: twilliamson 12/08/2014 [Mon 9:51am]
24X36 PLOT SCALE: 1:1 11"X17" PLOT SCALE: 1:2

24X36

000075

10,000 GAL HOLDING TANK

WASTE OIL TRANSFER FACILITY (50 GAL/MIN OWS)

DRIP TRAY SUMP

MW-49

MW-109

MW-115

WASTE OIL TRANSFER FACILITY

LOADING ARM

DRIP TRAYS

MW-50

SYSTEM DISCHARGE LINE TO OWS

MW-114

OW3-2

EXISTING COLLECTION SUMP

ELECTRICAL

ELECTRICAL PANEL

MW-126

8'x8' SKIMMER BUILDING

5,000L AST

14'x6' CONCRETE PAD

EXISTING TRENCH

FORMER SHOP TRACK FUELLING AREA DRS

EXISTING CONCRETE PAD

SKIMMER UNIT

BOLLARD (TYP.)

A

A

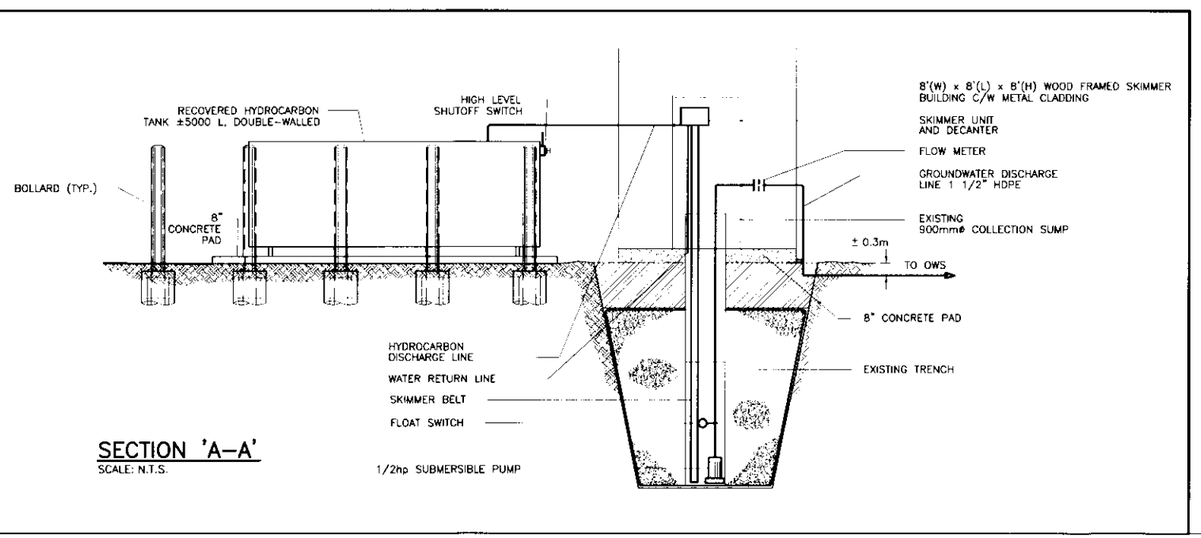
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AST

AST

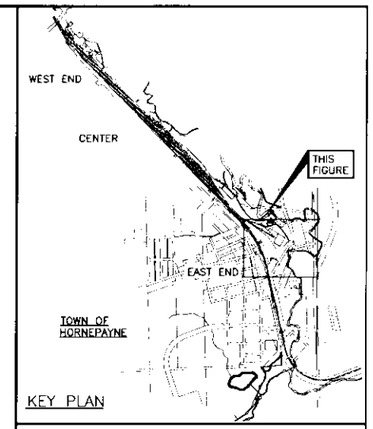
PARTIAL SITE PLAN

SCALE: 1:250



SECTION 'A-A'

SCALE: N.T.S.



KEY PLAN

LEGEND

- RAILROAD TRACK
- SANITARY SEWER
- STORM SEWER
- DISCHARGE LINE
- MW-126 MONITORING WELL (INSTALLED BY KGS) (MW101-MW133, MW140-MW147)
- MW-114 MONITORING WELL (INSTALLED BY OTHERS) (ALL OTHER WELLS)
- DESTROYED
- MANHOLES

0 5 10 15 20 25m

SCALE: 1:250 METRIC 24"x36"
1:500 METRIC 11"x17"

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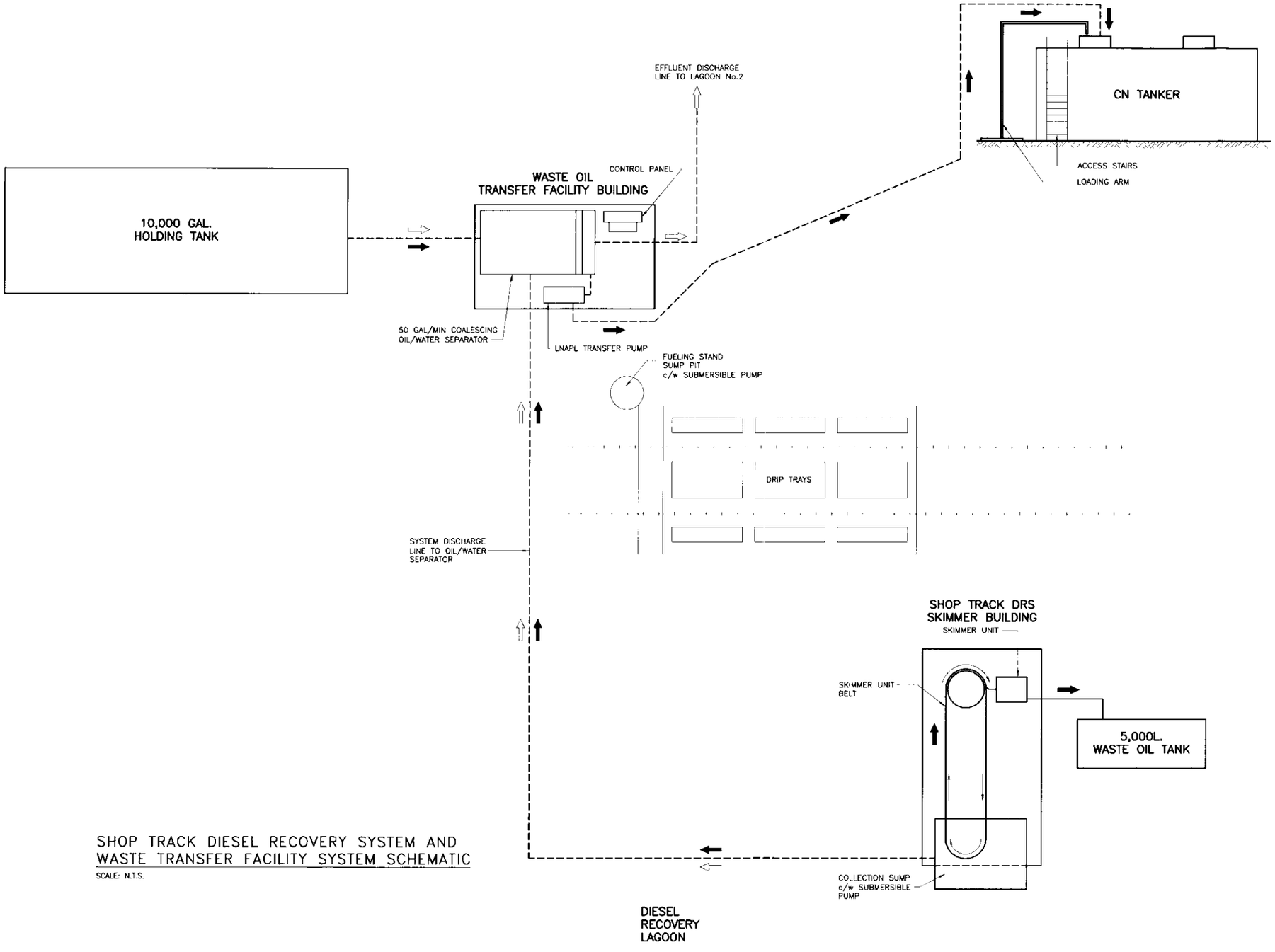
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FORMER SHOP TRACK FUELLING AREA SYSTEM COMPONENTS

DECEMBER 2014 | FIGURE 9 | REV 0

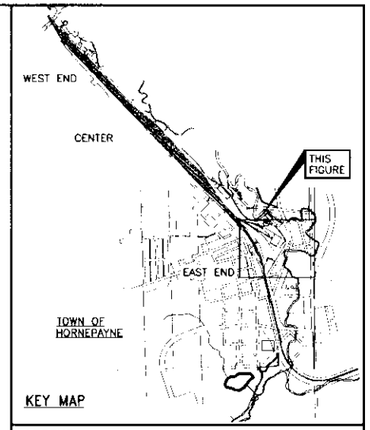
FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_Fig 9-Rev 0.dwg – Tab: FIG 9 Plotted By: twilkinson 12/08/2014 [Mon 9:54am]
24"x36" PLOT SCALE: 1:1 11"x17" PLOT SCALE: 1:2

24X36



SHOP TRACK DIESEL RECOVERY SYSTEM AND WASTE TRANSFER FACILITY SYSTEM SCHEMATIC

SCALE: N.T.S.



LEGEND:

- WATER FLOW
- LNAPL FLOW
- RAILROAD TRACKS
- UNDERGROUND PIPE
- HIDDEN OBJECTS

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/12/08	ISSUED WITH FINAL OPERATIONS MANUAL	TG
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SHOP TRACK DIESEL RECOVERY SYSTEM AND WASTE TRANSFER FACILTY SYSTEM SCHEMATIC

DECEMBER 2014 | FIGURE 10 | REV. 0

FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 10-Rev 0.dwg — Tab: FIG 10 Plotted By: twilliamson 12/08/2014 [Mon 9:56am]
24"x36" PLOT SCALE: 1:1 11"X17" PLOT SCALE: 1:2

0000078

FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 11-Rev 0.dwg - Tab: FIG 11 Plotted By: twilliamson 12/08/2014 [Mon 9:57am]
24"x36" PLOT SCALE: 1:1 11"x17" PLOT SCALE: 1:2

660000 E

661000 E

662000 E

663000 E

5456000 N

5455000 N

5454000 N

WEST END

LITTLE JACKFISH RIVER

SHOP TRACK DIESEL RECOVERY SYSTEM WASTE OIL TRANSFER FACILITY

EAST END

LEGEND

PLAN LIMITS

DIESEL RECOVERY SYSTEM DETAIL PLANS

0 100 200 300 400 500m

SCALE: 1:5000 METRIC 24"x36"
1:10000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
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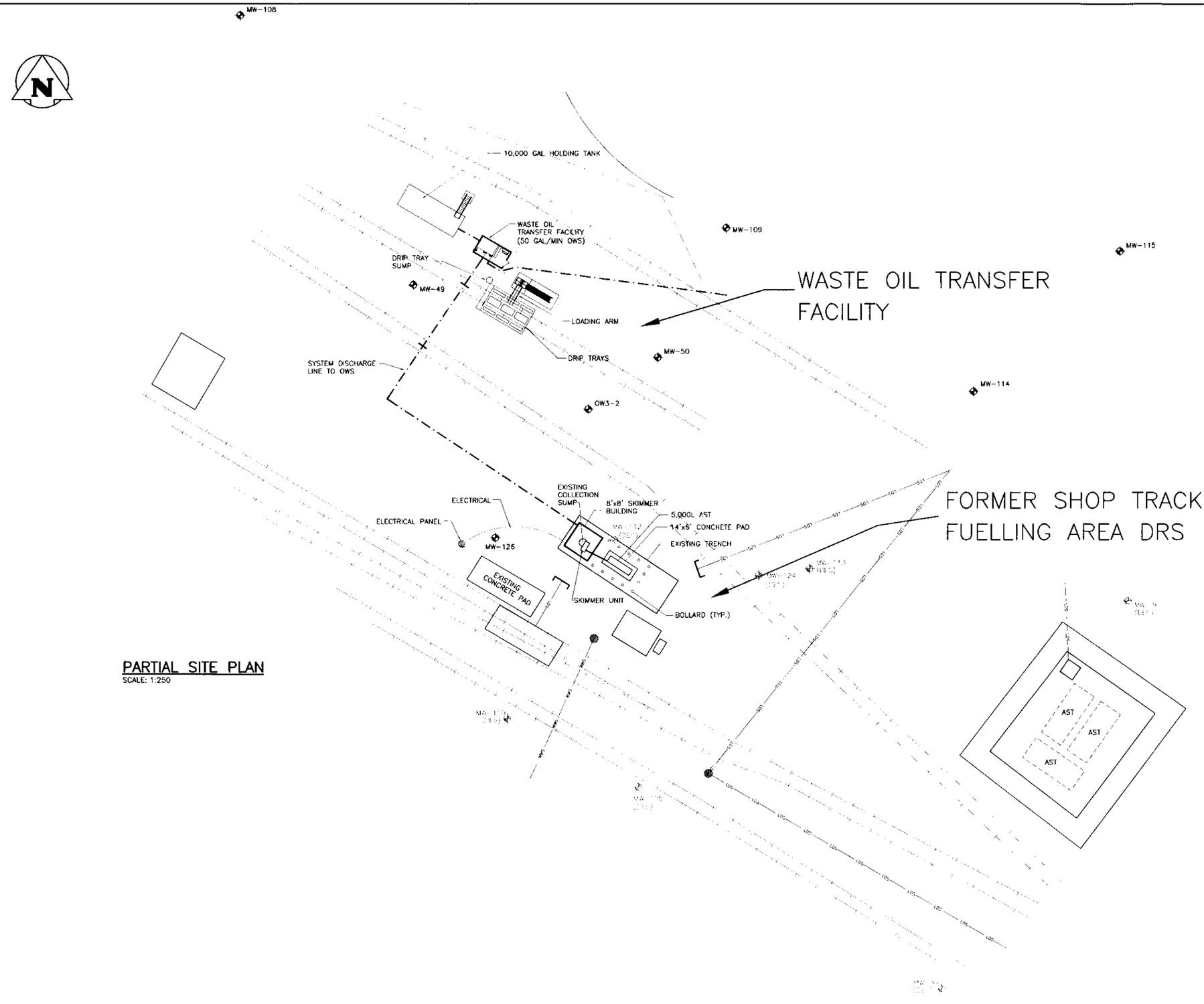
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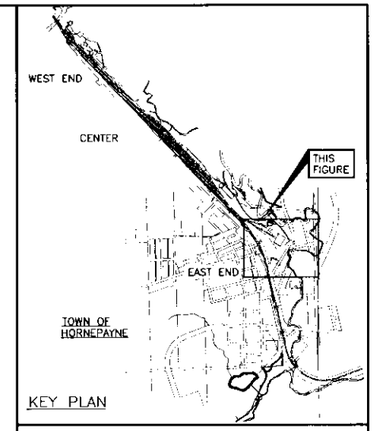
CN HORNEPAYNE YARD OPERATIONS MANUAL – CERTIFICATE OF APPROVAL No. 3528-83LQWT.

YARD LOCATION PLAN – WASTE TRANSFER FACILITY

DECEMBER 2014 | FIGURE 11 | REV. 0



PARTIAL SITE PLAN
SCALE: 1:250



LEGEND

- RAILROAD TRACK
- SANITARY SEWER
- STORM SEWER
- DISCHARGE LINE
- MW-126 MONITORING WELL (INSTALLED BY KGS) (MW101-MW133, MW140-MW147)
- MW-50 MONITORING WELL (INSTALLED BY OTHERS) (ALL OTHER WELLS)
- DESTROYED
- MANHOLES

0 5 10 15 20 25m

SCALE: 1:250 METRIC 24"x36"
1:500 METRIC 11"x17"

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CN HORNEPAYNE YARD OPERATIONS MANUAL CERTIFICATE OF APPROVAL No. 3528-83LQWT

WASTE OIL TRANSFER FACILITY SYSTEM COMPONENTS

DECEMBER 2014 | FIGURE 12 | REV 0

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FileName: P:\Projects\2014\14-0434-005\dwg\env\14-0434-005_FIG 12-Rev 0.dwg - Tab: FIG 12 Plotted By: twilkinson 12/08/2014 [Mon 9:58am]
24"x36" PLOT SCALE: 1:1 11"x17" PLOT SCALE: 1:2
000079

APPENDICES

APPENDIX A

EMERGENCY RESPONSE PLAN

EMERGENCY RESPONSE PLAN

MARCH 2013

Partners in
Responsible Care®

TABLE OF CONTENTS

LIST OF EXHIBITS iv
LIST OF ACRONYMS v
SECTION 1: INTRODUCTION 1
1.1 PURPOSE AND SCOPE OF PLAN 1
1.2 DOCUMENT FORMAT 2
1.3 LEGAL AUTHORITY AND REGULATORY CROSSWALK 3
1.4 ERP CUSTODIANS AND REVIEW PROCESS 6
SECTION 2: CORE PLAN 7
2.1 DISCOVERY 8
2.1.1 Emergency Recognition "What Am I Faced With?" 8
2.1.2 Initial Notification "Has the Notification Process Been Initiated?" 11
2.1.2.1 Required Incident Notifications 13
2.1.3 Preliminary Assessment "What Information Do I Need?" 18
2.1.3.1 Identifying the Incident Magnitude 18
2.1.3.2 Identifying the Specific Hazards Involved 18
2.1.3.3 Identifying the Magnitude of the Problem 18
2.1.3.4 Identifying the Populations or Resources Threatened 19
2.1.3.5 Safe Distances 19
2.1.4 Source Control "What Can I Do Now To Minimize The Outcome?" 19
2.2 INITIAL RESPONSE 19
2.2.1 Incident Command System - "Establish Organizational Control!" 20
2.2.1.1 CN's Incident Command System Organization 20
2.2.2 Unified Command (UC) Organization 21
2.2.3 Response Objectives and Priorities - "What is my overall objective?" 22
2.2.3.1 Response Priorities 22
2.2.3.2 Identifying Incident Objectives 22
2.2.3.3 Identifying Incident Strategies 23
2.2.3.4 Executing Tactical Direction 23
2.2.3.5 Emergency Response Logbook 23
2.2.3.6 Site Coordination / Communications 24
2.2.3.7 Additional Resources 24
2.2.4 Developing Tactical Plan and Mobilizing Resources "How Do I Accomplish My Strategic Objective?" 25
2.2.4.1 Initiating Protective Actions 25
2.2.4.2 Mitigating Action/Containment of the Release 25
2.3 SUSTAINED ACTIONS 26
2.3.1 Transfer of Command - "When and How Do I Transfer Command?" 26
2.3.2 Shift Rotations – "Brief Personnel!" 27
2.3.3 Logistical Support – "What Support Services Do I Need?" 27
2.4 TERMINATION AND FOLLOW-UP ACTIONS 27
2.4.1 Demobilization of Resources - "Plan and Document Release of Resources!" 27
2.4.2 Demobilization of Organizational Elements – "Plan and Document Demobilization of Organization!" 28
2.4.3 Incident Termination 28
2.4.4 Accident Investigation 28
2.4.5 Response Critique 28
SECTION 3: ANNEXES 30
Annex 1A: Notification - Canada 30
Annex 1B: Notification - U.S 37
Annex 2: System Protection Maps 43

Annex 3: Response Management System 58
1.0 INCIDENT COMMAND SYSTEM COMPONENTS AND FUNCTIONS 58
2.0 RELEASES OF HAZARDOUS SUBSTANCES THAT REQUIRE AN EMERGENCY RESPONSE (U.S. ONLY) 62
3.0 SITE SECURITY AND SITE MANAGEMENT 63
4.0 SHELTER-IN-PLACE PROCEDURES AND PLACES OF REFUGE 66
5.0 PERSONAL PROTECTIVE EQUIPMENT 66
6.0 DECONTAMINATION PROCEDURES 68
7.0 EMERGENCY MEDICAL TREATMENT AND FIRST AID 69
8.0 MEDICAL SURVEILLANCE AND CONSULTATION 70
9.0 EMERGENCY ALERTING AND COMMUNICATING NETWORK PROCEDURES (U.S. ONLY) 70
Annex 4: Emergency Response Training and Exercises 72
Annex 5: References 74
Annex 6: Environment Canada Storage Tank Regulations 75
SECTION 4: SITE-SPECIFIC SUPPLEMENTS 78
SECTION 5: LIST OF EMERGENCY CONTRACTORS 79

LIST OF EXHIBITS

Exhibit 1: Relationship between CN's Emergency Response Documents 2
Exhibit 2: Canadian Crosswalk to Identify Required Elements in Environment Canada Regulation SOR/2008-197 with the CN ERP 3
Exhibit 2A: Canadian Crosswalk to Identify Required Elements in the Transportation of Dangerous Goods Regulations Parts 7 and 8 with the CN ERP 3
Exhibit 2B: US Elements of OSHA HAZWOPER Emergency Response Requirements to Hazardous Substance Releases 4
Exhibit 3: Emergency Response Process (D.I.S.T.) 7
Exhibit 4: Information to be Provided by the First Witness to the Transportation Supervisor (Yard) or Rail Traffic Center (Main Track and All Other Locations) 10
Exhibit 5: Incident Notification Process 11
Exhibit 5A: Incident Notification Process for Greater Terminals 12
Exhibit 6: Incident Command System 21
Exhibit 7: CN's Incident Command System/Unified Command 22
Exhibit 8: Chain of Custody Form 24
Exhibit 9: Containment Actions 26
Exhibit 10: Response Critique Preparation 28
Exhibit 11: Incident Notification Contacts for CN's Canadian Operations 32
Exhibit 12: Resources Contacted As Conditions Warrant 32
Exhibit 13: Other Technical Resources Available Throughout Canada 33
Exhibit 14: Quantity of Dangerous Goods Requiring Immediate Reporting 34
Exhibit 15: Entities that Must Receive Immediate Reports of an Accidental or Imminent Release of a Dangerous Good 35
Exhibit 16: Contact Information for Notification of Environmental Incident 36
Exhibit 17: Incident Notification Contacts for CN's US Operations 37
Exhibit 18: Other Technical Resources for Spill Response 37
Exhibit 19: Contacts Required As Conditions Warrant 38
Exhibit 20: State and Local Reporting Contacts 39
Exhibit 21: Work Zones 64

LIST OF ACRONYMS

AAR	Association of American Railroads
ACC	American Chemical Council
AEI	Automatic Equipment Identification
BOE	Bureau of Explosives (AAR)
CANUTEC	Canadian Transport Emergency Centre (Transport Canada)
CCOH&S	Canadian Center for Occupational Health & Safety
CIAC	Chemical Industry Association of Canada
CEPA	Canadian Environmental Protection Act
CFR	Code of Federal Regulations (U.S.)
CHEMTREC	Chemical Transportation Emergency Center
CNDGAMP	CN Dangerous Goods Air Monitoring Protocol
CNEA	Canadian Nuclear Energy Agency
CTEH	Center for Toxicology and Environmental Health
DFO	Department of Fisheries and Oceans (Canada)
DGO	Dangerous Goods Officer
DGR	Dangerous Goods Responder
DND	Department of National Defense (Canada)
DOD	Department of Defense (U.S.)
DOE	Department of Energy (U.S.)
DOT	Department of Transportation (U.S.)
EC	Environment Canada
EMP	Environmental Management Procedures
EMT	Emergency Medical Technician
EO	Environmental Officer (Region Environmental Officer / Engineer)
EPA	Environmental Protection Agency (U.S.)
ERAP	Emergency Response Assistance Plan (Canada)
ERP	Emergency Response Plan
ETC	eBusiness and Transaction Center
FRA	Federal Railroad Administration
FWS	U.S. Fish and Wildlife Service
GOI	General Operating instructions
HAZWOPER	Hazardous Waste Operations and Emergency Response (U.S.)
HRSDC	Human Resources and Skills Development Canada
IC	Incident Command or Commander
ICS	Incident Command System
IDLH	Immediately Dangerous to Life or Health
LPGERC	Liquefied Petroleum Gas Emergency Response Corporation (Canada)
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NOC	Network Operations Center
NRC	National Response Center (U.S.)
NTSB	National Transportation Safety Board (U.S.)
OSHA	Occupational Safety and Health Administration (U.S.)
PAO	Public Affairs Officer
PPE	Personal Protective Equipment
RAC	Railway Association of Canada
RMO	Risk Management or Mitigation Officer
ROC	Region Operations Center
RTC	Rail Traffic Center
SCBA	Self-contained breathing apparatus
SOP	Standard Operating Procedures
TC	Transport Canada

TC/TDG	Transport Canada / Transportation of Dangerous Goods
TSB	Transportation Safety Board (Canada)

SECTION 1: INTRODUCTION

1.1 PURPOSE AND SCOPE OF PLAN

The purpose of this Emergency Response Plan is to explain the framework and procedures in place for CN's operations to safely and effectively respond to emergencies. ***An emergency consists of any accident, incident, or act of nature outside of regular CN operations.***

This plan is applicable to all operations involving CN property or employees system wide and covers accidents/incidents that may represent a potential hazard to people, property and the environment. This plan applies to any product which may pose a risk to public health and safety, responder health and safety, or to the environment, whether or not the product is regulated for transport.

This plan serves as the Emergency Response Assistance Plan (ERAP 2-0120) filed with Transport Canada and is developed in a manner to satisfy the U.S. Occupational Safety and Health Administration's requirements.

The Plan was developed to achieve the following objectives:

- To prevent injuries and save lives,
- To minimize environmental damage,
- To minimize property damage, and
- To ensure and provide for the continuity of business.

The Plan provides the framework for emergency response for CN's operations. Exhibit 1 and Annex 5 present the relationship of this Plan with other CN emergency response documents.

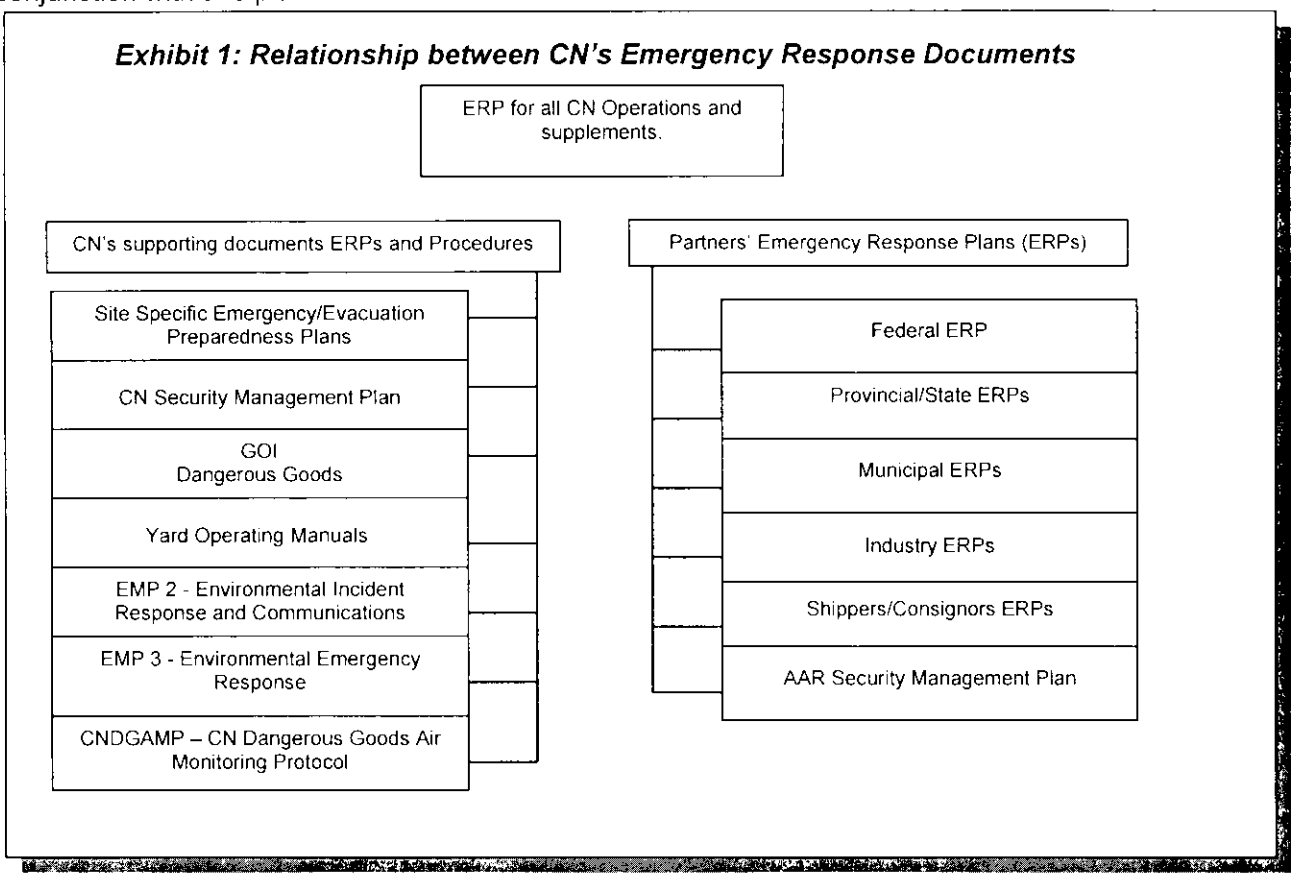
This plan supersedes all previous versions.

Electronic copies of the Emergency Response Plan, Incident Command Logbook, Supervisor Job Aid, Maps and Site Specific Supplements are available on the CN intranet at the following link under the heading "Emergency Response Plan":

http://cninet.cn.ca/SafetyRegulatoryAffairs/web/en/index.html

Exhibit 1 and Annex 5 reference emergency response documents that may be used in conjunction with this plan.

Exhibit 1: Relationship between CN's Emergency Response Documents



1.2 DOCUMENT FORMAT

This document has been specifically organized in a modular format to ensure that new or updated information can be easily incorporated. As such, there are five primary sections that, together, comprise the ERP:

1. Introduction
2. Core Plan
3. Annexes
4. Site-Specific Supplements
5. List of Emergency Contractors

The Introduction includes basic information that describes the purpose and scope of the Plan, documents the legal authority for the Plan, crosswalks the Plan's relationship to relevant Regulations, and documents how the Plan is amended.
The Core Plan describes the fundamental components of the emergency response process in the event of an accident/incident, release, or potential release, at any of CN's Operations.

The Annexes following the Core Plan provide additional information as referenced in other sections of the Plan.

The Site-Specific Supplements provide a general overview of the major yards, identify the populations or resources threatened, and include basic information about CN response equipment available at the site, as well as equipment that can be provided from first responders.

The Site-Specific Supplement is developed to be a stand-alone document that can be augmented as necessary. *It is expected that additional information will be incorporated into the Site-Specific supplements when available.*

1.3 LEGAL AUTHORITY AND REGULATORY CROSSWALK

This Plan was prepared by CN to ensure safe operations that protect the health and welfare of CN employees, the surrounding communities, and the environment. The Plan can be used in concert with local plans for emergency response. CN sites, in Canada, equipped with storage tanks must adhere to Environment Canada regulations. The crosswalk in Exhibit 2 identifies where the required elements for EC SOR/2008-197 are addressed in the CN ERP. Crosswalks of the requirements specified in Parts 7 and 8 of the Canadian Transportation of Dangerous Goods Regulations and OSHA 29 CFR Part 1910.120(q) are provided in Exhibits 2A and 2B.

Exhibit 2: Canadian Crosswalk to Identify Required Elements in Environment Canada Regulation SOR/2008-197 with the CN ERP

EC Reference	EC Requirement	Location in CN ERP
30.(1)(a)	Owner must include in their ERP the properties and characteristics of each product stored in the tanks.	Annex 6, CN-Intranet (MSDS and SAP)
30.(1)(b)	Owner must include in their ERP the characteristics of the location of the storage tanks.	Annex 6, E2MS
30.(2)(a)	Description of factors considered under 30.(1)	Addressed in 30.(1)
30.(2)(b)	Description of emergency response measures	Section 2 and Annex 4
30.(2)(c)	List of individuals who are required to carry out the plan and a description of their roles and responsibilities	Section 2
30.(2)(d)	Training requirements for individuals identified in 30.(2)(c)	Annex 4
30.(2)(e)	List of emergency response equipment and location	Sections 2, 4, and 5
30.(2)(f)	Measures taken to notify members of the public who may be adversely affected by harm or danger in 30.(2)(b)	Section 2
30.(3)(a) & (b)	The owner or operator of storage tank system must ensure the emergency response plan is ready to be implemented	Section 1 and 2
31.(1)	The owner or operator of storage tank system must keep the ERP up-to-date and a copy readily available for individuals who carry it out	Section 2

Exhibit 2A: Canadian Crosswalk to Identify Required Elements in the Transportation of Dangerous Goods Regulations Parts 7 and 8 with the CN ERP

TDGR Reference	TDGR Requirement	Location in CN ERP
TDGR Part 7	Emergency Response Assistance Plan	CN ERAP 2-0120 as per letter from TC dated February 14, 2006 confirming approval of CN ERAP as long as CN contract with LPGERC is in force and obligations on both parties are met.
TDGR 8.1	"Immediate Reporting"	Annex 1A
TDGR 8.2	"Immediate Reporting Information"	Annex 1A

Exhibit 2B: US Elements of OSHA HAZWOPER Emergency Response Requirements to Hazardous Substance Releases

Elements of OSHA HAZWOPER Emergency Response Requirements to Hazardous Substance Releases (29 CFR 1910.120(q))	LOCATION IN CN ERP
(1) Emergency response plan	Core Plan
(2) Elements of an emergency response plan	Introduction, Core Plan, Annexes
(i) Pre-emergency planning and coordination with outside parties	Introduction
(ii) Personnel roles, lines of authority, training, and communication	Core Plan Subpart 2.1.2; Annex 4
(iii) Emergency recognition and prevention	Core Plan Section 2.1.1
(iv) Safe distances and places of refuge	Annex 3 Subpart 3.0
(v) Site security and control	Annex 3 Subpart 3.0
(vi) Evacuation routes and procedures	Annex 3 Subpart 4.0
(vii) Decontamination procedures	Annex 3 Subpart 6.0
(viii) Emergency alerting and response procedures	Annex 3 Subpart 9.0
(ix) Emergency medical treatment and first aid	Annex 3 Subpart 7.0
(x) Critique of response and follow-up	Core Plan Section 2.4.5
(xi) PPE and emergency equipment	Annex 3 Subpart 5.0
(xii) Emergency response plan coordination and integration	Introduction and Core Plan
(3) Procedures for handling emergency response	
(i) The senior emergency response official responding to an emergency shall become the individual in charge of a site-specific Incident Command System (ICS)	Core Plan Section 2 and Annex 3 Subpart 1.0
(ii) The individual in charge of the ICS shall identify, to the extent possible, all hazardous substances or conditions present and shall address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance handling procedures, and use of any new technologies	Core Plan Section 2 and Annex 3 Subpart 1.0
(iii) Implementation of appropriate emergency operations and use of PPE	Core Plan Section 2 and Annex 3 Subpart 5.0
(iv) Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self-contained breathing apparatus while engaged in emergency response	Annex 3 Subpart 5.0
(v) The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site, in those areas of potential or actual exposure to incident or site hazards, to those who are actively performing emergency operations	Annex 3 Subpart 3.0
(vi) Backup personnel shall stand by with equipment ready to provide assistance or rescue	Annex 3 Subpart 4.0

Elements of OSHA HAZWOPER Emergency Response Requirements to Hazardous Substance Releases (29 CFR 1910.120(q))	LOCATION IN CN ERP
(vii) The individual in charge of the ICS shall designate a safety official, who is knowledgeable in the operations being implemented at the emergency response site	Annex 3 Subpart 1.0
(viii) When activities are judged by the safety official to be an IDLH condition and/or to involve an imminent danger condition, the safety official shall have authority to alter, suspend, or terminate those activities	Annex 3 Subpart 1.0
(ix) After emergency operations have terminated, the individual in charge of the ICS shall implement appropriate decontamination procedures	Annex 3 Subpart 6.0
(x) When deemed necessary for meeting the tasks at hand, approved self-contained breathing apparatus (SCBA)-may be used with approved cylinders from other approved self-contained breathing apparatus provided that such cylinders are of the same capacity and pressure rating	Annex 3 Subpart 5.0
(4) Skilled support personnel	Annex 4
(5) Specialist employees	Annex 4
(6) Training	Annex 4
(7) Trainers	Annex 4
(8) Refresher Training	Annex 4
(9) Medical surveillance and consultation	Annex 3 Subpart 8.0
(10) Chemical protective clothing	Annex 3 Subpart 5.0
(11) Post-emergency response operations	Core Plan Section 2.4

1.4 ERP CUSTODIANS AND REVIEW PROCESS

System Safety and Emergency Response	System Environment
Danny Simpson **(Chicago)** AVP Safety & Emergency Response Office: (708) 332-3125 Fax: (708) 332-3052 E-mail:danny.simpson@cn.ca	**Normand Pellerin** **(Montreal)** AVP Environment Office: (514) 399-7400 Fax: (514) 399-8573 E-mail: normand.pellerin@cn.ca
Southern Region	**System Safety**
Jim Schwichtenberg **(Chicago)** Director – Safety & Regulatory Affairs Office: (708) 332-6567 Fax: (708) 332-3052 E-mail: jim.schwichtenberg@cn.ca	**Sam Berrada** **(Montreal)** General Manager Safety & Regulatory Office: (514) 399-5662 Fax: (514) 399-7899 E-mail: sam.berrada@cn.ca
Eastern Region	**Western Region**
Bob Bruder **(Toronto)** Senior Manager-Risk Management Office: (905) 669-3326 Fax: (905) 760-3490 E-mail: robert.bruder@cn.ca	**Don Penney** **(Edmonton)** Senior Manager-Risk Management Office: (780) 472-3480 Fax: (780) 472-3903 E-mail: don.penney@cn.ca
Dangerous Goods	
Jean Ouellette **(Montreal)** Director – Dangerous Goods Office: (514) 399-6623 Fax: (514) 399-7427 E-mail: jean.ouellette@cn.ca	

Note that the numbers above are NOT emergency response numbers.

In case of an Emergency contact the CN Police Communication Centre at:

1-800-465-9239

Note: The ERP is reviewed and updated by the custodians and key stakeholders every two (2) years. Any suggestions can be provided to one of the custodians.

SECTION 2: CORE PLAN

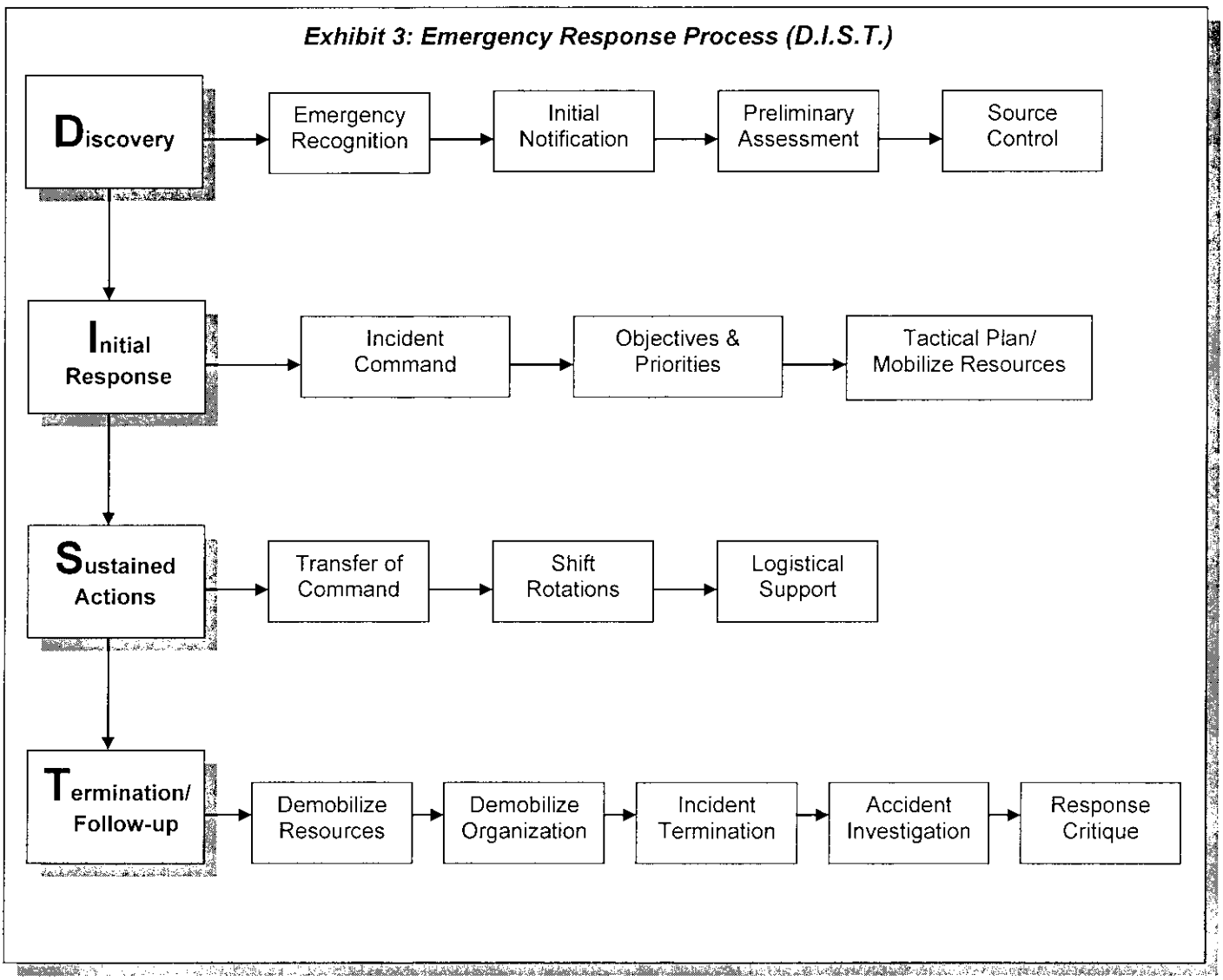
This Core Plan describes the fundamental components of CN's emergency response process. This section provides the critical information necessary to understand how CN's Operations personnel respond to emergencies.

INITIATE EMERGENCY RESPONSE LOGBOOK IMMEDIATELY.

- This is essential in order to maintain an accurate event timeline, implement effective emergency response and protect CN's interests. Refer to **Section 2.2.3.5**

Additional information and response tools (e.g., Job Aids) for several of the response actions identified in this section can be found in Annex 3. Exhibit 3 below depicts the basic activities and actions that are involved in the Emergency Response Process. The procedures associated with each activity or action are elaborated further in this section.

Exhibit 3: Emergency Response Process (D.I.S.T.)



2.1 DISCOVERY

This part describes the initial actions to be taken by the person(s) discovering an incident prior to the commencement of any initial response activities. Actions discussed in this section include emergency recognition, initial notification, preliminary assessment of the situation, and source control.

2.1.1 Emergency Recognition *"What Am I Faced With?"*

Anyone on CN property who encounters an emergency should follow the following steps:

1. Protect the movement of cars and immediately advise the Transportation Supervisor (i.e. Assistant Superintendent, Trainmaster, Yardmaster, etc...) if operating within yards or Rail Traffic Center if operating outside of yards.

   Note: When notified of a yard incident, ***the Transportation Supervisor is responsible for immediately notifying the Rail Traffic Center or Network Operations Center if the incident should occur at one of the following Greater Terminals: Toronto, Winnipeg, Edmonton, Vancouver and Prince George.***

2. As required, communicate with the CN Police Communication Center (1-800-465-9239). If deemed necessary, notify directly the municipal responders (Fire, Police, Emergency Medical Services (EMS)) by calling 911. EMS and ambulance shall be notified when there are injuries or suspected injuries and the fire department shall be notified if there is a potential for, or an actual fire.
3. Keep clear of the incident scene and take immediate action to warn the public and other employees.
4. Avoid any exposure to smoke or fumes, and keep all open flames, including cigarettes, pipes, etc. away from the incident scene.
5. If the locomotive is not directly involved in the incident, cut the movement as close as possible to the incident location, and remove the remaining cars to a safe distance.
6. If a fire or vapor cloud is present and/or dangerous goods/hazardous materials are known to be involved, employees shall move to a safe distance up wind. Bring the shipping papers and emergency response information. Determine the status of the train from this point and advise the appropriate contact.
7. Reference Exhibit 4 for the information to provide to the Transportation Supervisor or Rail Traffic Center as soon as possible: For example:
   - Determine as quickly as possible the cars directly involved in the incident, as well as those in close proximity to them.
   - Before approaching the cars, identify the products involved by referencing any of the following:
     - Train journal / consist (confirm accuracy with latest AEI reading and records of cars picked up/set off en route)
     - Shipping documents / Waybill
     - Switch lists and any other available documentation
     - Emergency response information: (Emergency Response Guidebook)
     - Appropriate resources to obtain critical information (SRS-HAZ, MSDS, etc...)

- Determine which cars contain products that may pose a risk to employee / public health and safety or to the environment by providing:
    - Car numbers
    - Contents
    - Emergency response telephone numbers
    - Condition of the cars

  Even if they are not involved in the incident, but are located near the cars involved, this information should also be obtained for cars containing products which may pose environmental, health, or safety hazards.

  In the event that such information is unavailable, contact the Transportation Supervisor or Rail Traffic Center for assistance in identifying the goods involved.
- Inform other crew members of products involved and any hazards that may be present.
- In all situations, cooperate with emergency response personnel. Provide information from the shipping papers. Make available emergency response information to arriving emergency response personnel. Retain possession of all original copies of the shipping papers and the train journal / consist until they can be delivered to the relieving company officer.
- The Public Affairs Officer (PAO) will be the point of contact for the media, or other organizations seeking information directly from the incident or event. Consistent with CN policy, it is important that CN personnel not volunteer information, make guesses or estimates, or offer opinions related to the incident unless authorized to do so by the PAO.

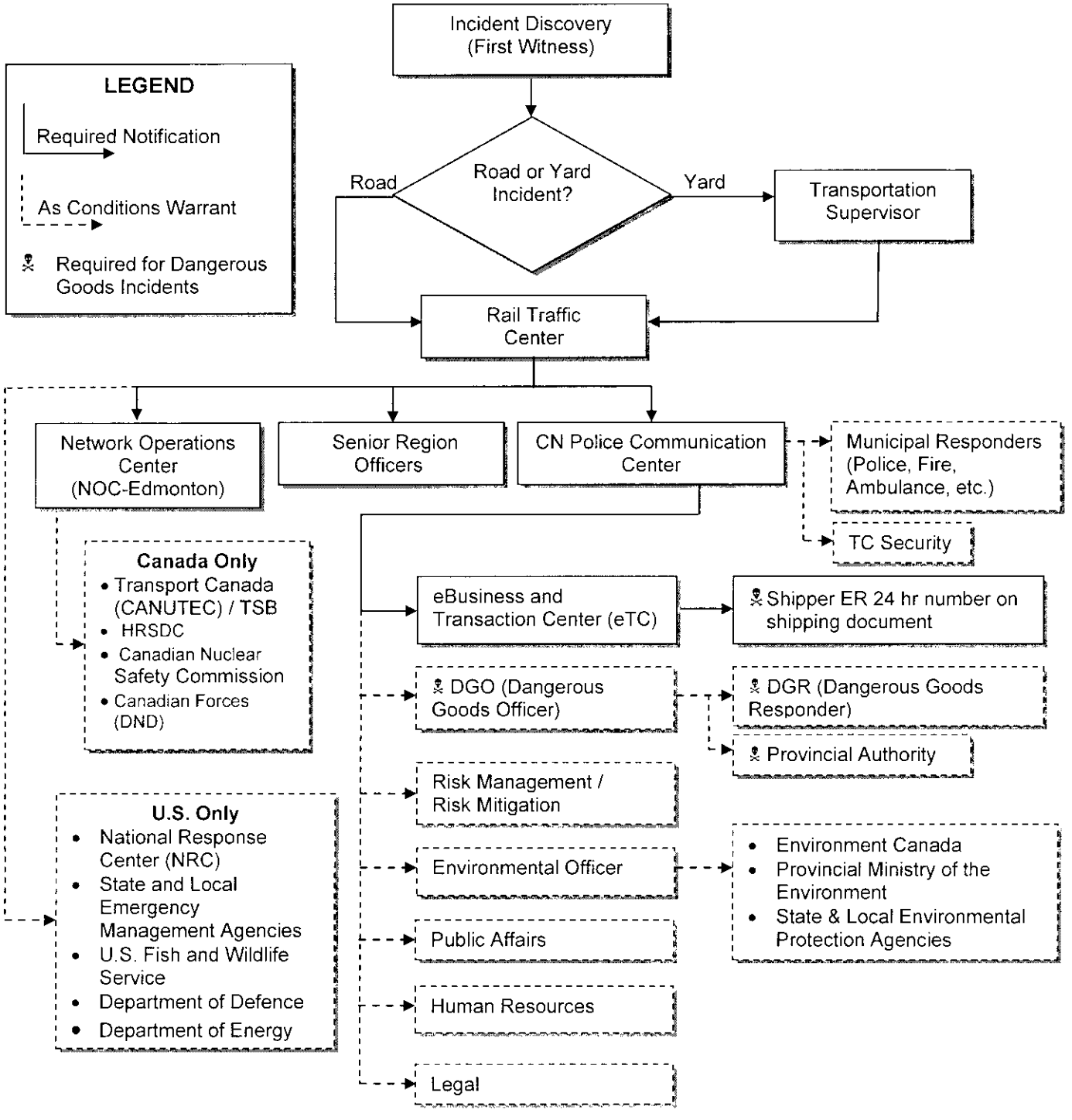
Exhibit 4: Information to be Provided by the First Witness to the Transportation Supervisor (Yard) or Rail Traffic Center (Main Track and All Other Locations)

• Name, title (call-back number) of the person making the report.	
• Nature and extent of any injuries.	
• Exact location of incident (subdivision and mileage).	
• Time incident occurred.	
• Numbers and types of the cars that are directly involved in the incident and those in close proximity to the incident.	
• Products contained in the cars directly involved in the incident and those in close proximity to the incident.	
• When a release or suspected release has occurred, the approximate rate of release and volume released.	
• Action taken (leaking car isolated, etc.).	
• Status and condition of the cars directly involved in the incident and those in close proximity to the incident.	
• Prevailing weather conditions (rain, wind direction and speed, etc.).	
• Surroundings, such as nearness to populated areas, terrain, and local bodies of water, in order to gauge danger to persons and the environment.	
• Resources necessary to handle the situation, such as fire, ambulance, or law enforcement agencies.	
• Location where a member of the crew will meet arriving emergency response personnel.	
• Name of shipper and origin.	
• Name of consignee and destination.	

2.1.2 Initial Notification *"Has the Notification Process Been Initiated?"*

The incident notification process for CN is presented in Exhibit 5 below and explained on the following pages. ***See Exhibit 5A for the Incident Notification Process that applies to the following Greater Terminals: Toronto, Winnipeg, Edmonton, Vancouver & Prince George.***

Exhibit 5: Incident Notification Process

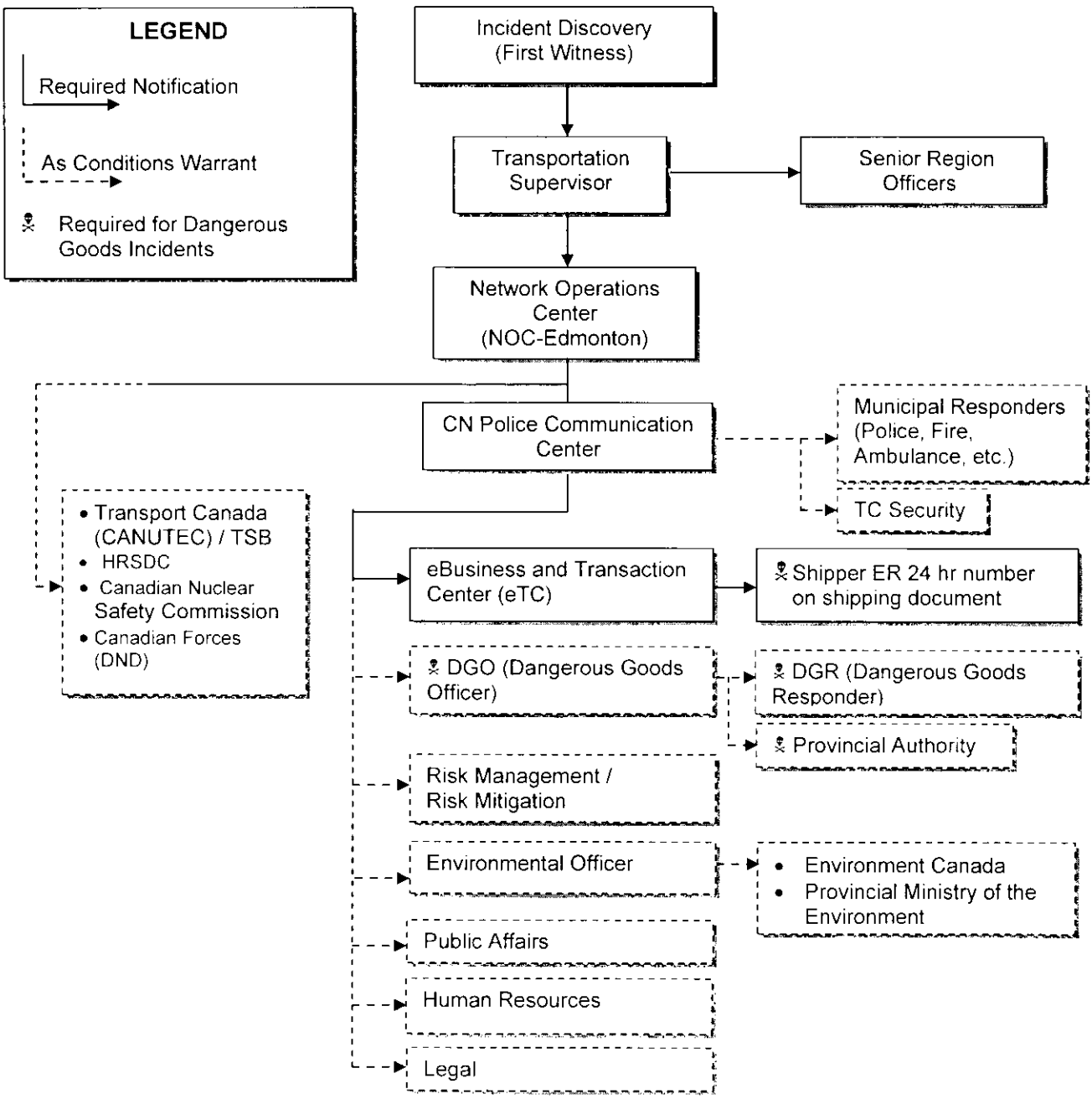


The Incident Notification Process in Exhibit 5A applies to the following Greater Terminals:

- Toronto
- Winnipeg
- Edmonton
- Vancouver
- Prince George

See Exhibit 5 for all other locations.

Exhibit 5A: Incident Notification Process for Greater Terminals



Exhibits 5 and 5A provide an overview of the incident notification process for a typical emergency involving dangerous goods / hazardous materials or any other product which may pose a risk to employees, responder and/or public health and safety, or the environment. This process can be divided into two components: (1) incident notifications required regardless of the incident conditions; and (2) incident notifications required only as conditions warrant. Each of these processes is described in further detail below. In addition, Annex 1A and Annex 1B "Notification", provide detailed criteria and contact information for notification.

2.1.2.1 Required Incident Notifications

This section describes contacts that are required in the event of any incident regardless of size or magnitude including any emergency involving dangerous goods / hazardous materials or any other product which may pose a risk to employees, responder and/or public health and safety, or the environment.

First Witness (Road vs. Yard Incident)

When a report of an incident or potential for an incident occurs in a CN yard, the first witness is responsible for immediately notifying the Transportation Supervisor. When the incident occurs on main track or any other location, the first witness must immediately contact the Rail Traffic Center directly.

Transportation Supervisor or Senior CN Operations Officer

The Transportation Supervisor is a generic term for the most senior CN Operations Officer at the scene of the incident. The Transportation Supervisor will serve as the CN Incident Commander (described in more detail throughout the Core Plan - Section 2) until the position is transferred to a more senior individual. The Transportation Supervisor is responsible for:

- Advising operations employees to warn all persons not to approach damaged or derailed cars until the hazardous properties of all materials have been identified and/or contained or the site has been declared safe;
- Instructing operations employees to remain at the scene, unless safety is threatened, with all documentation until relieved;
- Ensuring that the Rail Traffic Center has been notified without delay, or, in the event the incident occurred at one of the 5 Greater Terminals listed in Exhibit 5A, the Network Operations Center (NOC);
- Advising Senior Region Officers if the incident has occurred at one of the 5 Greater Terminals listed in Exhibit 5A;
- As required, communicate with the CN Police Communication Center (1-800-465-9239). As deemed necessary, the CN Police Communication Center will arrange a conference call to directly notify municipal responders (Fire, Police, EMS).

Rail Traffic Center

As depicted in Exhibit 5, when notified of an emergency regardless of magnitude, the Rail Traffic Center is responsible for immediately generating a flash report and for coordinating the incident notification process by contacting the Network Operations Center (NOC), Senior Region Officers and CN Police Communication Center (refer to descriptions below). For significant accidents, and following the initial notifications, the RTC will coordinate conference calls to review the emergency progress with key stakeholders.

If the incident has taken place at one of the 5 Greater Terminals listed in Exhibit 5A, the Transportation Supervisor will be responsible for advising Senior Region Officers, while the

Network Operations Center will then be responsible for the other Rail Traffic Center duties listed above.

1) Network Operations Center (NOC)

The NOC is responsible for contacting Regulatory Agencies such as Transport Canada (CANUTEC), the TSB, HRSDC, etc...:

In the event the incident occurred at one of the 5 Greater Terminals listed in Exhibit 5A, the NOC will be responsible for advising the CN Police Communication Center.

a) Transport Canada (CANUTEC) / Transportation Safety Board (TSB)

CANUTEC is the Canadian Transport Emergency Center operated by Transport Canada. CANUTEC provides advisory services and is staffed by professional chemists experienced and trained in interpreting technical information and providing emergency response advice. They also maintain the largest library of MSDS information in Canada.

If the situation dictates, the NOC may also be responsible for arranging prompt notification of additional government agencies, as described in more detail below.

b) Additional Government Agencies

In Canada the NOC is responsible for arranging prompt notification of additional government agencies, as the situation dictates, including:

- HRSDC
- Canadian Nuclear Safety Commission; and
- Canadian Forces (DND).

2) Senior Region Officers

In the event of an emergency (main track, yard, etc...) the Rail Traffic Center will notify Senior Region Officers, or confirm that they have been notified. In the event the incident occurred at one of the 5 Greater Terminals listed in Exhibit 5A, the Transportation Supervisor will be responsible for advising the Senior Region Officers.

The Senior Region Officers are composed of personnel from the Region, including:

- Region Senior Vice-President;
- Region Vice-President;
- General Manager;
- General Superintendent / Superintendent;
- Mechanical, Engineering, and Transportation Officers;
- Engineering Line Operations Officer.

All Senior Region Officers are called unless the Rail Traffic Center / Transportation Supervisor have been advised of an alternate person on call. Usually within an hour of the event, Senior Region Officers will conduct a preliminary assessment of the situation, including identifying the incident type, identifying the specific hazards involved, identifying the magnitude of the problem, and identifying the populations or resources threatened.

Senior Region Officers may delegate authority to the Dangerous Goods Officer (DGO) until any products posing a threat to employee, responder and/or public health and safety, or the environment are under control.

3) *CN Police*

In the event of an emergency, the CN Police Communication Center is responsible for making the initial notification to the entities listed below as per Exhibit 5 and 5A.

a) Transport Canada Security

b) Municipal Responders

As conditions warrant, the CN Police Communication Center will notify municipal responders (Fire, Police, Ambulance). EMT and ambulance should be notified when there are injuries or suspected injuries and the fire department shall be notified if there is a potential for, or an actual fire.

c) eBusiness and Transaction Center

The ETC is responsible to efficiently deliver electronic copies of consists, waybills, MSDSs, etc. to the NOC, RTCs, responders, and other parties as required. The ETC is responsible for customer advisals following the incident, including contacting the Shipper Emergency Response 24 hour number on shipping document. The ETC is also responsible for coordinating the acquisition of rail cars for possible transload operations. After receiving initial notification of an incident, the ETC will be responsible for contacting the RTC centers and the NOC to obtain periodic status updates throughout the course of the incident.

i. Shipper ER 24-Hour Number on Shipping Document

For emergencies involving dangerous goods/hazardous materials, the ETC shall immediately notify the shipper using the 24-hour number on the shipping document, whether or not emergency response is required.

During incidents involving products which may pose environmental, health, or safety hazards, the Incident Commander shall obtain the relevant Material Safety Data Sheet (MSDS) from the eBusiness and Transaction Center.

d) Dangerous Goods Officer (DGO)

CN Police Communication Center shall notify the DGO for all incidents involving dangerous goods/hazardous materials or any other products posing a threat to employee, responder and/or public health and safety. As conditions warrant, the DGO will notify:

i. Dangerous Goods Responders

ii. Provincial Authority (as per Exhibit 14)

e) Risk Management / Risk Mitigation

CN Police Communication Center shall notify Risk Management / Risk Mitigation to assist in areas such as:

- Significant derailments and injuries
- Evacuation
- Right of way fires

f) Environmental Officer (EO)

As conditions warrant, the CN Police Communication Center will notify the EO who is then responsible for immediately reporting any size spill or potential spill that has or is likely to have an environmental impact, or that has entered the provincial environment

(e.g., traveled off CN property), regardless of amount, to the appropriate Federal / Provincial / State Ministry of the Environment.

Such notification shall be made to the EO even when no release exists but a car / intermodal unit incurs damage that may result in a possible leak. As conditions warrant, the EO will notify the following entities:

i. **Environment Canada, Provincial Ministry of the Environment, State and Local Environmental Protection Agencies.**

g) CN Public Affairs

Public Affairs will be notified by the CN Police Communication Center for emergencies such as those:

- Affecting the public or the environment; and/or
- That have already or are likely to come to the attention of the news media.

h) CN Human Resources Department

The Regional Representative for the Human Resources Department will be notified by CN Police for significant employee injuries (eg. loss of limb, loss of life, etc...) or emergencies that may raise potential labor issues.

i) CN Legal

As well, CN Police is responsible for site security and control (refer to Annex 3, Part 3.0) and taking all actions and decisions required under the circumstances to:

- Save lives;
- Prevent injuries;
- Provide safety to the general public and CN personnel; and
- Protect property within the CN right-of-way.

The CN Police will act as the liaison with local police as necessary.

4) U.S. Only Notifications

For the U.S., the RTC shall make the following additional notifications when required:

a) National Response Center

In the U.S., at the earliest practicable moment, the RTC should notify the National Response Center after each incident that occurs during the course of transportation (including loading, unloading and temporary storage), as required by 49 CFR 171.15. The NRC is responsible for contacting other Federal agencies, including:

- The Environmental Protection Agency (EPA): Responsible for assuring environmental clean-up. The Agency must be notified of releases of reportable quantities;
- The Department of Transportation (DOT): Notified of all incidents that occur during the course of transportation (including loading, unloading and temporary storage);
- The U.S. Coast Guard (USCG): Primarily concerned with water pollution. The U.S. Coast Guard works closely with EPA, and may substitute for EPA where spills occur only in water and adjacent land;
- The Department of Energy (DOE): DOE is notified if the incident involves radioactive materials. DOE provides assistance in handling incidents involving radioactive materials.

In addition to DOE, State Radiation Control Programs can, in most situations, provide the most prompt radiological advice as well as assistance at the scene of an accident. They are also prepared to assess all types of radioactivity. In most states, the radiation control program has the responsibility for at least initial radiological assessment of a transportation accident. In general, vehicle operators should notify the state radiation control authority of any incident that delays their progress.

A list of State Radiation Control Program Assistance Contacts by state can be obtained by contacting the Rail Traffic Center;

- The Nuclear Regulatory Commission (Nuc. Reg. Com);
- The National Transportation Safety Board (NTSB): Investigates serious or newsworthy accidents. The NRC will notify the NTSB if the incident meets the reporting requirements; and
- The Federal Railroad Administration (FRA) Investigates the incident if any of the following occurs involving a shipment of hazardous material:
    - A person is killed;
    - An injury involves hospitalization;
    - Estimated property damage exceeds $50,000;
    - Fire, breakage, spillage, or suspected contamination involves radioactive materials or etiological agents; or

A situation exists of such nature that, in the judgment of the carrier, it should be reported.

b) State and Local Emergency Management Agencies

State and local emergency management agencies have reporting requirements that vary. Annex 1 provides a complete list of contact information and initial reporting requirements.

c) U.S. Fish and Wildlife Service

As conditions warrant, the RTC shall contact the U.S. Fish and Wildlife Service (FWS), and the appropriate state departments of natural resources.

d) U.S. Department of Defense

The Department of Defense (DOD) is notified of incidents involving DOD escorted shipments ("White Train"). Incidents are reported to the Albuquerque Operations Office.

e) *U.S. Department of Energy*

The Department of Energy (DOE) is notified if the incident involves radioactive materials. DOE will provide assistance with communications and arrange for technical advice for emergency responders to a radioactive material transportation incident. DOE will, if requested, provide on-scene radiological assistance to support state and local responders through the regional coordinating offices of its Radiological Assistance Program.

Additional Assistance for Incidents Involving Radioactive Materials

In addition to DOE, State Radiation Control Programs can, in most situations, provide the most prompt radiological advice as well as assistance at the scene of an accident. They are also prepared to assess all types of radioactivity. In most states, the radiation control program has the responsibility for at least initial radiological assessment of a transportation accident. In general, vehicle operators should notify the state radiation control authority of any incident that delays their progress.

A list of State Radiation Control Program Assistance Contacts by state can be obtained by contacting the RTC.

Section 2.1.2 provides an overview of the players involved in the initial notification process for emergencies. Annex 1A and Annex 1B provide detailed criteria for regulatory and response notification, the requirements for providing follow-up documentation, and contact lists and telephone numbers for response and regulatory reporting.

System Protection Maps identifying responders geographically, including their respective contact information, are available in Annex 2 for the following:

- Risk Management
- Dangerous Goods
- Environment
- CN Police
- Public Affairs
- Risk Mitigation (U.S.)
- Damage Prevention

2.1.3 Preliminary Assessment *"What Information Do I Need?"*

This part describes the process of assessing the situation beyond the initial discovery, including an identification of the incident type, the specific hazards involved, and the magnitude of the problem.

2.1.3.1 Identifying the Incident Magnitude

In order to allocate the appropriate response resources, the Senior Region Officer will consider all the available incident information to determine the Incident Magnitude. For incidents involving products which may pose environmental, health, or safety hazards, the Senior Region Officer will consult with the DGO and/or EO in order to properly understand the incident magnitude.

2.1.3.2 Identifying the Specific Hazards Involved

The IC and/or DGO and/or EO will seek input from all available resources in order to identify all of the products that may be involved in the incident. The products involved may be identified from information contained in the documentation listed below:

- Train journal / Consist
- Shipping documents / Waybill
- Switch lists and any other available documentation
- Emergency response information: (Emergency Response Guidebook)
- Contact appropriate resources to obtain critical information (SRS-HAZ, MSDS, CANUTEC/CHEMTREC, etc...)

In the U.S., regulations require that train crews have in their possession a copy of the Emergency Response Guidebook, which provides potential hazards and immediate action information for dangerous goods/hazardous materials.

Federal Regulations require that a shipping document accompany all shipments of dangerous goods/hazardous materials.

2.1.3.3 Identifying the Magnitude of the Problem

As soon as possible after the discovery of an incident an initial assessment is performed to determine the magnitude of the problem. The IC is responsible for assessing the magnitude of

the incident in consultation with the DGO, the EO, and/or any qualified resource. The assessment includes, but is not limited to, the following:

- Identification of the nature, amount, and location of released materials;
- Identification of materials involved in the incident, even if they are not released;
- Evaluation of the threat to human health;
- Determination of the probable direction and time of travel for released materials;
- Identification of possible exposure pathways for humans and the environment; and
- Identification of potential impacts on human health and safety, the environment, natural resources, and property (see Regional Supplements).

2.1.3.4 Identifying the Populations or Resources Threatened

Upon notification of an incident, the RTC will use all available information to quickly identify the location of any incident, the possible materials involved, the homes, farms, or other domiciles in the immediate area and details of the terrain. This information should be provided to the Senior Region Officer as well as onsite responders. Certain site supplements (Section 4) provide information regarding population and resources threatened at selected yards.

Onsite responders should consult the table of Initial Isolation and Protective Action Distances contained in the *Emergency Response Guidebook*.

2.1.3.5 Safe Distances

The process described above will also be used to identify safe distances for all personnel that may be at the site of an incident that are not properly trained to respond to an incident involving hazardous materials.

2.1.4 Source Control *"What Can I Do Now To Minimize The Outcome?"*

When products involved may pose environmental, health, or safety hazards, extreme caution must be taken by all concerned. At no time shall operations resume until the area has been declared safe. In certain circumstances it is possible to take immediate actions ***safely*** to minimize the impact, including:

- Moving car(s) to an isolated track
- Confining release to CN property
- Isolate affected area by controlling access and activating notification process

2.2 INITIAL RESPONSE

Initial response will vary significantly depending on the magnitude of the incident. Most minor incidents will not necessitate the execution of all activities described in this part. The remediation of many incidents can be successfully handled with CN resources in a very short time. In these cases, the situation will be assessed by first responders in much the same manner as described in the previous part, including identifying the incident type, the specific hazards involved, the magnitude of the problem, and the populations or resources threatened. For Dangerous Goods incidents, regardless of the assessment, the eTC is always informed and subsequently informs the customer / shipper / consignee.

Incidents involving more serious consequences may warrant Senior Region Officer intervention. Depending on the assessment, RTC may be instructed to notify additional response entities. In this situation, the customer / shipper / consignee and/or mutual aid assistance teams will play a larger role in the response effort.

2.2.1 Incident Command System - "Establish Organizational Control!"

This part describes CN's Incident Command System (ICS), which is its system for response management. In addition, the concept of Unified Command, which brings together, as partners, all response organizations at the scene of an incident, is also discussed.

2.2.1.1 CN's Incident Command System Organization

The ICS facilitates the rapid mobilization and effective use of resources needed to carry out and support emergency or non-emergency response operations. Although the ICS is highly structured, it provides for the flexibility of command needed to adjust to the dynamic nature of the incident. At the same time, the ICS maintains continuity of command throughout the conduct of response operations. For these reasons, the ICS is equally suited for small and large incidents.

Every emergency has major management actions or functions that must be performed. Even if the event is very small, and only one or two people are involved, these functions will still apply to some degree. The ICS divides an emergency response into five manageable functions that are essential for emergency response operations:

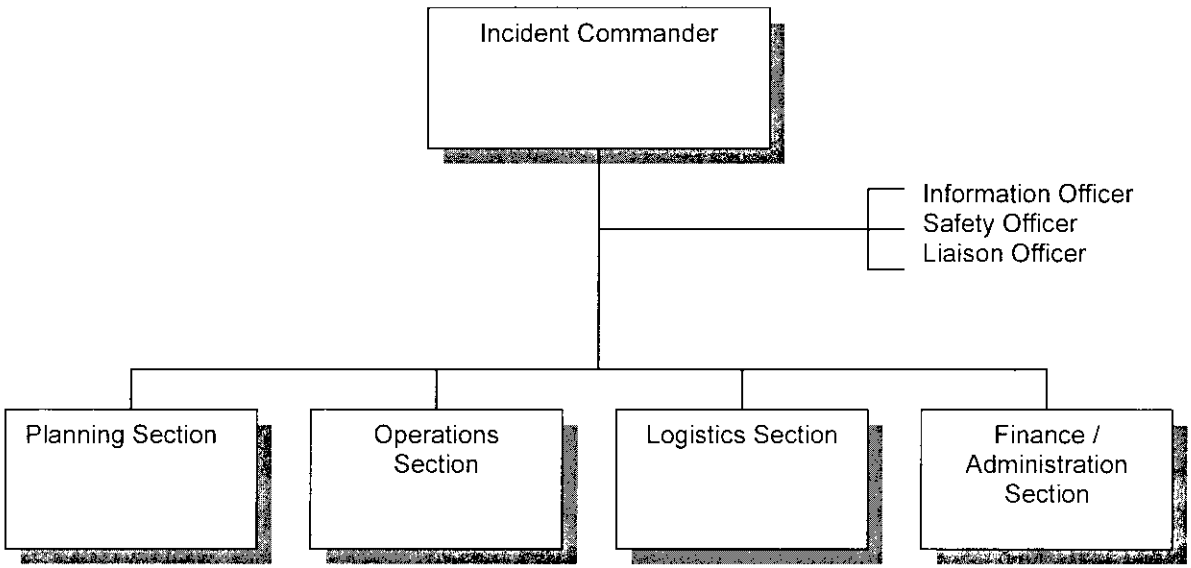
1. **Command** (which includes the Incident Commander as well as his or her "Command Staff," as included in the positions of Safety, Information, and Liaison);
2. **Operations;**
3. **Planning**;
4. **Logistics**; and
5. **Finance/Administration**.

These five major management functions are the foundation upon which the ICS organization develops. They apply for handling a routine emergency, organizing for a major event, or managing a major response to a disaster. The ICS provides maximum flexibility to activate as many positions within the functional areas as are necessary to handle the magnitude of an incident.

On small incidents, one or all of the five major functions may be managed by the Incident Commander (IC). Large incidents usually require that each function be set up as a separate section within the system. Exhibit 6 illustrates the ICS that would most likely be established in the event of a major incident. There is no one "best" way to organize, thus the organization should adapt to meet the needs of the incident. The characteristics of the incident and the management needs of the IC determine what organization elements should be established. If the incident is small, it may not be necessary to establish all of the branches depicted in Exhibit 6. Conversely, if an incident begins to escalate, it may be beneficial to organize additional branches under the direction of the most appropriate function to address specific needs, as demands dictate. It is also important to recognize that, in the majority of incidents, several of the functions and activities depicted in Exhibit 6 may be performed by entities such as emergency response teams provided by the shipper / consignee, mutual aid assistance teams, or local/municipal response organizations. It is not expected that CN personnel will have to fill each position identified. It is the responsibility of the IC to coordinate the response effort and ensure that each necessary activity/function is being performed efficiently by someone involved in the response effort. Furthermore, the incident organization may change over time to reflect the various phases of the incident (more complex organization to handle more complex incidents).

Annex 3 contains a brief description of the roles of each of the 5 functions depicted in Exhibit 6.

Exhibit 6: Incident Command System



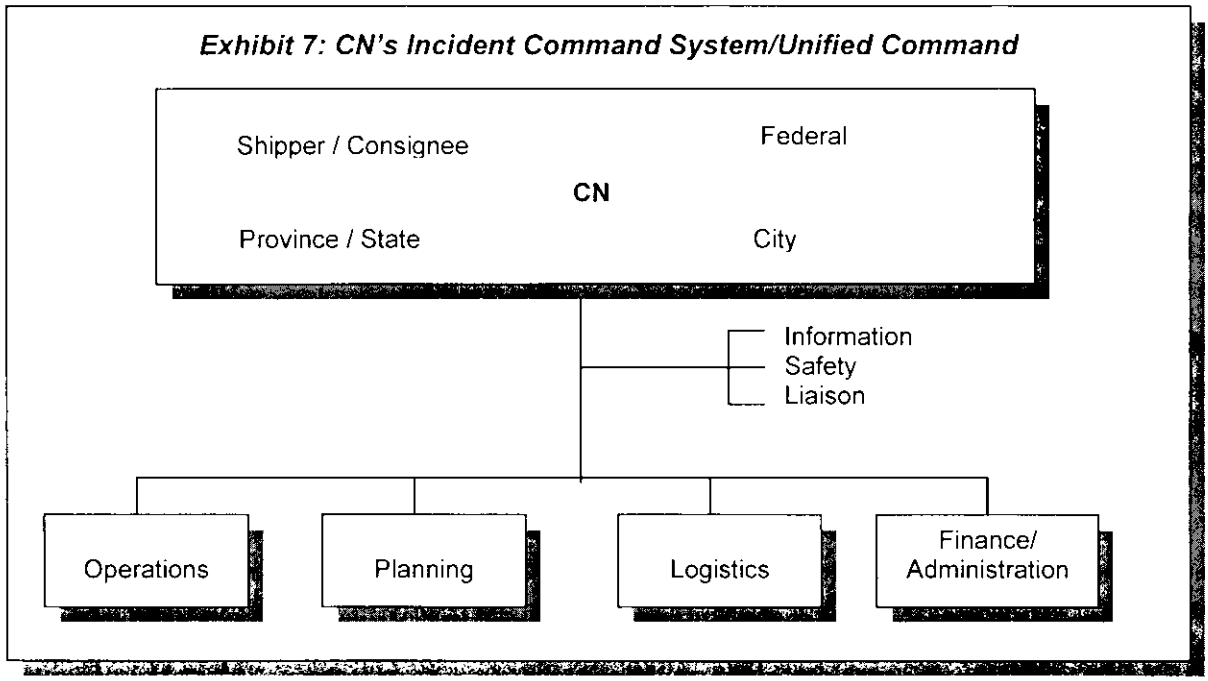
2.2.2 Unified Command (UC) Organization

Incidents at a yard, along main track, or on other railway property may also have the potential for offsite consequences and various authorities may join the response effort. CN embraces the Unified Command (UC) concept where several response organizations are brought together as partners in the response effort, including provincial / state and regional response organizations, federal representatives, and the shipper / consignee and/or its mutual aid partners. UC provides guidelines for agencies with different legal, geographic, and functional responsibilities to work together effectively. UC is a team effort that allows all agencies with responsibility for the incident, either jurisdictional or functional, to jointly provide direction to an incident through a common set of incident objectives and strategies. This is accomplished without losing or abdicating agency authority, responsibility, or accountability.

In the event of a major incident the UC would most likely consist of representatives from the shipper / consignee, the province / state, the city, and/or federal representatives (Exhibit 7). Each of these representatives in the UC retains authority to control the resources it provides to the response effort. Provincial / state and federal legislation allow for an authority outside of the railway, such as a mayor, police chief, fire chief, or federal representative to assume the role of the IC.

UC provides for shared involvement of the various responding organizations. It creates the link between the organizations responding to the incident and provides a forum for these agencies to make decisions. Under UC, the various jurisdictions and/or agencies are blended together throughout the ICS to create an integrated response team (Exhibit 7).

ICS/UC also ensures that information is shared both horizontally and vertically throughout the response organization, allowing the response to be conducted effectively. CN may also establish a Joint Information Center, so the response effort is represented to the public by one unified voice.



2.2.3 Response Objectives and Priorities - *"What is my overall objective?"*

This part identifies CN's response priorities and describes the process for identifying incident objectives and strategies, and executing tactical direction.

2.2.3.1 Response Priorities

All CN employees must understand that their role at an emergency is to work with all responding organizations to bring the incident to a safe conclusion. CN personnel will manage their own resources, while striving to interact and cooperate effectively with other responding entities through the principles of ICS/UC.

CN response priorities are:

- Immediate life safety;
- Health of affected persons;
- Protection of public and private property;
- Protection of the environment; and
- Continuity of business.

2.2.3.2 Identifying Incident Objectives

Once an ICS has been established, the IC or UC is responsible for determining the incident objectives, strategy, and tactical direction. Incident objectives are statements of intent related to the overall incident. For some kinds of incidents the time to achieve the objectives is critical. In others, time, while always important, may not be an overriding issue. All incident objectives must be measurable. In addition to the objectives outlined in Section 1.1, the following are further examples of incident objectives:

- Stop the release of dangerous goods / hazardous materials;
- Contain fire within existing structures;
- Search affected area for injured persons or casualties;

- Stop the flow of toxic or other materials to environmentally sensitive areas (example: lakes, rivers, sewers, etc...); or
- Stop the release of any other product which may pose a risk to people, property, the public, and/or the environment;
- Contain and plan for remediation of any spilled product which may pose a risk to people, property, the public, and/or the environment

2.2.3.3 Identifying Incident Strategies

The IC should develop appropriate strategies describing the methodology that will be used in achieving the incident objective.

2.2.3.4 Executing Tactical Direction

Tactical direction describes what must be accomplished within the selected strategy or strategies in order to achieve the incident objectives. Tactical direction is the responsibility of the IC or the Operations Section Chief if that position has been established. Jointly developed tactics can assure understanding and enhance commitment. This is particularly important when the incident involves personnel from multiple disciplines.

2.2.3.5 Emergency Response Logbook

The CN Senior Officer in-charge is responsible for keeping records of all information relative to emergencies. For significant emergencies involving an incident command post, a document entitled "Emergency Response-Incident Command Logbook" shall be used. The IC will start a logbook immediately upon arrival at the scene. The logbook shall record all relevant information such as:

- Basic Information (IC Org. Chart, Duty Roster, Meeting Schedules, etc...)
- Meetings and documentation provided to external agencies
- Documents (journal, waybills, MSDS, etc...)
- Service Restoration
- Environmental Restoration
- Safety Plan requested by regulators

For significant emergencies the IC will appoint a person responsible for the logbook and documentation. The logbook will be turned over to the incoming IC to continue recording events. The incoming IC shall spend time during the transfer of command to discuss with the outgoing IC the initial response objectives and priorities that were established during the initial response phase. During this discussion, the two ICs should assess the accomplishments that have been achieved, as well as the issues remaining, in order to reassess the initial objectives and identify long-term goals.

The NOC and RTC's shall record all relevant information for all emergencies. This will include all persons / agencies / organizations contacted, date / time of contact, information provided / obtained, etc...

The Incident Command Logbook must be sent to Regional Law or their designate within two weeks of Termination.

The IC is responsible for ensuring that the Chain of Custody Form in Exhibit 8 is used continuously from the inception of the emergency. This form is available in the IC Logbook.

For smaller scale emergencies, a document entitled "Emergency Response-Supervisor Job Aid" is available.

Exhibit 8: Chain of Custody Form

CN Chain of Custody Form

Original Location: _____
Date Removed: _____ Time Removed _____
Name and Title of Person Removed By _____
Signature: _____

First Transfer :
Date of transfer _____ Time of transfer: _____
Transferred from: _____
Delivery method (Hand Delivery, Courier, Mail, etc.): _____
Transferred to (name of person delivered to): _____
At (location delivered to): _____
Date received: _____ Time received: _____
I attest that the above information regarding the first transfer is true and correct.
Signature of Transferer: _____ Date: _____
Signature of Receiver: _____ Date: _____

Third Transfer :
Date of transfer: _____ Time of transfer _____
Transferred from: _____
Delivery method (Hand Delivery, Courier, Mail, etc.): _____
Tran

2.2.3.6 Site Coordination / Communications

The Incident Commander must ensure that the Unified Command System maintains effective communications throughout the emergency response.

This will ensure that all responders involved in the emergency response have an opportunity to provide input into the response objectives and priorities, while remaining updated on the evolution of strategies and tactical activities. This approach will allow all responders to coordinate their respective activities safely and efficiently.

Effective communications need to be achieved through the unified command system and regular briefings with responders. Briefings must be held frequently at the onset of emergency response activities (ex: every 4 hours or as required by circumstances), and the time between briefings can be extended as emergency response activities stabilize and risks diminish.

For incidents involving the establishment of a command post by CN, or in conjunction with an outside agency, CN Police will control site security using the Emergency Access Pass System (EAPS) and/or the Restricted Access Control System (RACS); refer to Annex 3 Part 3.0.

2.2.3.7 Additional Resources

Additional technical resources, including response equipment and specialized capabilities are referenced in (Annex 1A and Annex 1B). These resources include:

- Center for Toxicology and Environmental Health (CTEH)
- Transportation Technology Center, Inc. (TTCI)
- LPG Emergency Response Corporation (LPG-ERC)
- Explosive Service International
- Railway Association of Canada (RAC) Dangerous Goods Specialists
- Association of American Railroads (AAR)

2.2.4 Developing Tactical Plan and Mobilizing Resources
"How Do I Accomplish My Strategic Objective?"

This part describes the process for initiating protective actions and conducting mitigating actions appropriate to the incident, including control and containment of a release.

2.2.4.1 Initiating Protective Actions

In the event of an emergency, protection of life and health is the first concern. When in doubt, the safest course of action must be taken. If an evacuation is required, CN has the decisional authority to evacuate personnel on CN property. CN may assist in simultaneously notifying nearby businesses and the community, however, it is the decision and responsibility of local authorities (e.g., police and fire departments) to initiate protective actions, such as evacuations, for the communities outside CN's operations. (Annex 3) provides detailed evacuation and shelter-in-place procedures for CN's Operations.

2.2.4.2 Mitigating Action/Containment of the Release

Once personnel and population protective measures have been activated, CN personnel will take action to prevent, mitigate, or minimize the threat. In determining the appropriate extent of action to be taken at a given release or spill, the preliminary assessment and current conditions must be evaluated. The following factors should be considered in determining the appropriate mitigating actions:

Exposure to products which may pose environmental, health, or safety hazards to nearby populations, animals, or food chains;

- Contamination of drinking water supplies or sensitive ecosystems;
- Pollutants, or contaminants in storage containers that may pose a threat of release;
- High levels of products which may pose environmental, health, or safety hazards, or contaminants in soils, largely at or near the surface, that may spread;
- Weather conditions that may facilitate the spread or release of substances;
- Threat of fire or explosion;
- The availability of other response mechanisms; and
- Other situations or factors that may pose threats to public health, welfare, or the environment.

Should a determination be made that an action is necessary to contain the source of the release, or potential for a release, actions should be taken as soon as possible to prevent and minimize the threat to public health, welfare, or the environment. Exhibit 9 identifies containment actions that are appropriate in the corresponding situations identified. Additional procedures for terrorist threats or incidents involving threats to security are referenced in (Annex 5).

Exhibit 9: Containment Actions

Situation	Potential Action
Where humans or animals have access to the release	Fences, warning signs, or other security or site control precautions
Where precipitation or runoff from other sources may enter the release area	Drainage controls
Where needed to maintain the integrity of the structures	Stabilization of berms, dikes, or impoundments
Where needed to reduce the spread of dangerous goods/hazardous materials into soil, groundwater, or air	Capping of contaminated soils or sludge
Where use of such chemicals will reduce the spread of release	Using chemicals or other materials to retard the spread of release or to mitigate its effects
Where removal will reduce the spread of contamination	Removal of contaminated soils from drainage or other areas
Where it will reduce the likelihood of spillage, leakage, exposure to humans, animals or food chain, or fire or explosion	Removal of bulk containers that hold dangerous goods/hazardous materials
Where it will reduce the likelihood of exposure of humans or animals to contaminated water	Provision of alternative water supply

2.3 SUSTAINED ACTIONS

This part describes the process of transition from the initial emergency stage to the sustained action stage involving more prolonged mitigation and recovery actions. This includes transferring command, shift rotations, and obtaining logistical support.

Almost every emergency will require that activity transition from the initial emergency response stage to the sustained action stage involving more prolonged mitigation and recovery actions. When this occurs, it is often necessary to provide shift rotations to relieve first responders who may have been on-scene for several hours. One of the main features of ICS is the ability to transfer command and staff positions with minimum disruption.

2.3.1 Transfer of Command - *"When and How Do I Transfer Command?"*

Transfer of command may take place when a more senior person arrives at the scene and elects or has been designated by higher authority to assume the position of IC. This often occurs when an incident continues to escalate. Transfer of command can also take place in reverse (e.g., transferring command to a less senior or less experienced person in an incident that is under control or moving toward demobilization). In addition, transfers may also be

needed for personnel assigned to assume command or staff positions for continued operations. The decision to transfer command is based on complexity of the incident, qualifications, and experience. Prior to every command transfer, the current IC should ensure that:

- An Incident Command Post has been established;
- Transfer of command will take place face-to-face, if possible;
- A briefing or status report is provided to the incoming commander; and
- Appropriate notifications are made to incident personnel and appropriate non-incident locations.

2.3.2 Shift Rotations – *"Brief Personnel!"*

Face-to-face briefings between outgoing and incoming personnel should be performed to cover relevant issues such as:

- The situation status;
- Objectives and priorities;
- The current organization;
- Resource assignments;
- Resources en route and/or ordered;
- Facilities established;
- Communications Plan; and
- Prognosis, concerns, related issues.

2.3.3 Logistical Support – *"What Support Services Do I Need?"*

In the event that a response extends for several days, CN's Logistics Section of the ICS becomes increasingly important in meeting the demands of personnel and resources directly assigned to the incident. In a large scale incident, the Service and Support Units of the Logistics function will be responsible for ensuring that all responders are provided with sufficient resources (food, water, sleeping areas, medical, transportation services, etc...)

2.4 TERMINATION AND FOLLOW-UP ACTIONS

This subsection describes the process for concluding a response, including demobilizing response resources, demobilizing organizational elements, and incident termination, including follow-up actions such as accident investigation and response critique.

2.4.1 Demobilization of Resources - *"Plan and Document Release of Resources!"*

At all times during an incident, and especially at the conclusion of response activities, the IC and staff members must determine when assigned resources are no longer required to meet incident objectives. Excess resources must be released in a timely manner to reduce incident-related costs, and to "free up" resources for other assignments.

During larger incidents, especially those that may have personnel and tactical resources from several organizations or jurisdictions, it is important for the IC to coordinate the development and the communication of a detailed demobilization plan to all stakeholders in order to release resources expediently and effectively.

Demobilization of key resources (wrecking services, ER contractors, etc...) shall be recorded in the Emergency Response Logbook.

2.4.2 Demobilization of Organizational Elements – *"Plan and Document Demobilization of Organization!"*

As the response nears conclusion, it is appropriate to demobilize units, branches and sections as conditions warrant. Anytime a unit, branch, or section is demobilized, the function it was performing goes to the next higher level in the chain of command. This process must be communicated to all stakeholders.

2.4.3 Incident Termination

After consultation with each of the Section Chiefs, the IC will determine that the incident objectives have been met and response operations can be terminated. After further consultation with the Operations Officers, including the mechanical, engineering, and transportation units, the IC will declare that the area is safe and business operations may resume at their normal capacity. Even after the response has been terminated and the ICS has been deactivated, it is possible that some members of various functions, such as the Environmental Protection Unit or Mechanical Unit, may require further participation (either on-site or off-site) to conclude the incident response, such as overseeing clean up and remediation efforts.

2.4.4 Accident Investigation

All incident investigation results will be documented and the information entered into SAP (CN's safety database).

2.4.5 Response Critique

When deemed appropriate by senior company officers an internal response critique will be carried out. The critique is intended to identify lessons learned to improve the response to future incidents. The critique could include a discussion of the incident, the factors involved, the dangerous goods/hazardous materials involved, the response actions taken, whether the existing procedures and resources functioned as expected; improvements to procedures and resources, and needs for additional training, equipment, and communications. A response critique with external parties such as the local fire department may also be carried out.

Each region is responsible to maintain oversight on the response critique process.

Exhibit 10 provides useful tools to assist in structuring and planning the emergency response critique.

Exhibit 10: Response Critique Preparation

The following chart should be completed as required for each of the 8 key items to be reviewed in the Response Critique. The 8 key items are listed following the chart, also included is additional information for each item to be considered when preparing the final review.

Item:	
Strong points & Successes	**Weak points & Deficiencies**
1.	1.
2.	2.
3.	3.
4.	4.
Suggestions for Improvement:	

Exhibit 10 (continued): Response Critique Preparation

Item 1 - Notification Process Internal and External

- Emergency recognition
- Initial notification
- Preliminary assessment of the situation

Item 2 - Incident Command System/Unified Command System

- Command Post
- Central log
- Chain of custody
- Briefings
- Interface with Regulatory Agencies
- Interface with Emergency Response Teams & Contractors
- Access to necessary resources / people
- Internal & External communications
- Crisis communications / Public affairs
- Incident termination & follow-up

Item 3 – Safety

- Site Safety Practices
- Levels of Protection
- Air Monitoring
- Protective Clothing
- Air Supply
- Perimeter - Hot Zone /Decon/ Warm Zone / Cold Zone
- Entry Team Action
- Decontamination
- Medical monitoring
- Public protection (evacuate/shelter in place)

Item 4 - Damage Assessment

Item 5 - Site Security

Item 6 – Claims

Item 7 – Containment / Confinement

- Containment
- Plugging
- Patching
- Capping
- Replacing / repairing
- Confinement
- Diking
- Excavation
- Booming
- Pumping
- Vapour suppression

Item 8 - Other Comments

SECTION 3: ANNEXES

Annex 1A: Notification - Canada

All relevant notifications shall be made as per Exhibits 5 and 5A: Incident Notification Process of the Core Plan.

TSB REPORTING REGULATIONS

Refer to TSB Regulation for definitions and further detail as well as applicable job aids relevant to the following:

1) Reportable Railway Accident:

A reportable railway accident means an accident resulting directly from the operation of rolling stock, where:

a. A person sustains a serious injury* or is killed as a result of:
   i. Being on board or getting on or off the rolling stock, or
   ii. coming into contact with any part of the rolling stock or its contents,

b. the rolling stock:
   i. Is involved in a grade-Crossing collision, (all crossing accidents are reportable with or without injuries or fatalities).
   ii. Is involved in a collision or derailment and is carrying passengers,
   iii. Is involved in a collision or derailment and is carrying dangerous goods, or is known to have last contained dangerous goods the residue of which has not been purged from the rolling stock,
   iv. Sustains damage that affects its safe operation, or
   v. Causes or sustains a fire or explosion or causes damage to the railway that poses a threat to the safety of any person, property or the environment.

2) Reportable Railway Incident

A Reportable Railway Incident means an incident resulting directly from the operation of rolling stock, where:

a. A risk of collision occurs
b. An unprotected main track switch is left in an abnormal position,
c. A railway signal displays a less restrictive indication than that required for the intended movement of rolling stock,
d. An unprotected overlap of operating authorities occurs,
e. A movement of rolling stocks exceeds the limits of its authority,
f. There is runaway rolling stock,
g. Any crew member whose duties are directly related to the safe operation of the rolling stock is unable to perform the crew member's duties as a result of a physical incapacitation that poses a threat to any person, property, or the environment, or
h. Any dangerous goods are released on board or from the rolling stock,

* An injury that is likely to require admission to a hospital.

TDG REPORTING REGULATIONS

Under Part 8 of the Canadian Transportation of Dangerous Goods Regulations (TDGR), CN will immediately report an accidental or imminent release of dangerous goods from a means of containment if the release of dangerous goods or an emission of radiation exceeds the quantity or emission level set out in Exhibit 14. CN must immediately report the accidental release to the entities listed in Exhibit 15.

An immediate report of an imminent accidental release is considered to be an immediate report for any subsequent accidental release. Only one immediate report is required for each incident.

In places where a 911 telephone number is available, a report made via that telephone number would ensure that both the local police and local fire department are aware of the incident. In places where a 911 telephone number is not available, it is expected that when a report is made directly to the local police they will inform the local fire department.

The immediate report must include as much of the following information as is known at the time of the report:

- the shipping name or UN number of the dangerous goods;
- the quantity of dangerous goods that:
    - was in the means of containment before the accidental release, and
    - is known or suspected to have been released;
- a description of the condition of the means of containment from which the dangerous goods were released, including details as to whether the conditions of transport were normal when the means of containment failed;
- for an accidental release from a cylinder that has suffered a catastrophic failure, a description of the way the cylinder failed such as an explosion, a valve sheared off, or a crack in the cylinder;
- the location of the accidental release;
- the number of deaths and injuries resulting from the accidental release; and an estimate of the number of people evacuated from private residences, public areas, or public buildings resulting from the accidental release.

HRSDC REPORTING REGULATIONS

Under the COSH regulations and On-Board Trains OSH regulations of the Canada Labour Code, the following injuries must be reported by telephone as soon as possible:

Employee Other than Train Crew on Train (report to be made to HRSDC at 1-800-641-4049)

- Fatality
- Disabling injury (will result in lost time or modified duties) to two or more employees
- Loss of a body member or a part thereof of the complete loss of the usefulness of a body member or part thereof
- Permanent impairment of a body function

Train Crew Member on Train (report to be made to CANUTEC who handle train crew injuries on behalf of HRSDC at 613-998-6666)

- Fatality
- Disabling injury (will result in lost time or modified duties) to two or more employees

Exhibit 11: Incident Notification Contacts for CN's Canadian Operations

Contact	Telephone Number
Network Operations Center (NOC) – in EDM	1-780-472-4003
Rail Traffic Center (Montreal)	1-514-399-4892
Rail Traffic Center (Toronto)	1-905-760-3837
Rail Traffic Center (Edmonton)	1-780-472-3999
Transportation Supervisor	Location Dependent
eBusiness & Transaction Center (ETC)	1-204-470-7928
Transport Canada (CANUTEC)	1-613-996-6666
Transportation Safety Board	1-819-997-7887
Senior Region Officers	Contacted by RTC
Dangerous Goods Officer	Contacted by CN Police
Environmental Officer	Contacted by CN Police
Shipper	Contacted by ETC 24-hour number provided on Waybill
Risk Management and General Claims	Contacted by CN Police
Public Affairs	Contacted by CN Police
CN Police	1-800-465-9239

Exhibit 12: Resources Contacted As Conditions Warrant

Contact	Contact Information
Municipal Responders (Police, Fire, Ambulance, etc.)	911 (emergency)
Human Resources Development Canada/Labour Canada	1-800-641-4049
Canadian Nuclear Safety Commission	Duty Officer 613-995-0479

OTHER TECHNICAL RESOURCES AVAILABLE THROUGHOUT CANADA

Depending on the circumstances, CN has access to a number of technical resources, which will be notified by the NOC if conditions warrant. These resources include:

- *Center for Toxicology and Environmental Health (CTEH)* - provides expertise in toxicology, risk assessment, cost recovery, environment, industrial hygiene, occupational, and medical issues during a response.
- *LPG Emergency Response Corporation* - provides response personnel that are trained in the handling, storage and/or transportation of LPG products and containers to provide emergency response assistance on a 24-hour basis.
- *Transportation Technology Center, Inc. (TTCI)* - provides Dangerous Goods Specialists with Incident Command System expertise and the ability to facilitate a coordinated multi-agency response and provide on-scene strategic and technical planning.
- *Explosive Service International* – provides assistance when explosives are required for response operations.
- *Railway Association of Canada (RAC) Dangerous Goods Specialists* - provide advice and expertise to railway personnel responsible for handling incidents involving dangerous goods. This includes liaison with customers and emergency response contractors to obtain additional expertise and specialized equipment, as required.

Contact information for these resources is provided in Exhibit 13. Resources available to a specific yard are identified in the yard supplements.

Exhibit 13: Other Technical Resources Available Throughout Canada

Contact	Contact Information	
Center for Toxicology and Environmental Health (CTEH) Little Rock, AR	866-869-2834	
LPG Emergency Response Corporation	800-265-0212	
Transportation Technology Center, Inc. (TTCI) Pueblo, CO	Director, Hazmat Services	Office: 719-584-0661
Explosive Service International Baton Rouge, LA	**Billy Poe**	Office: 225-275-2152 Home: 225-273-5545 Pager: 225-233-0156 Cellular: 225-603-8984
Railway Association of Canada (RAC) Dangerous Goods Specialists	**Andy Ash** RAC Director Dangerous Goods	Office: 905-953-8991 Fax: 905-953-9279 Cellular: 647-206-2896 Email: ANDYA@RAILCAN.CA
	Jean-Pierre Couture RAC - DG Specialist Eastern Canada	Office: 450-473-4459 Fax: 450-473-8835 Cellular: 514-891-8935 Pager: 514-339-2137 J7R 3R8 Email: JEANPC@RAILCAN.CA
	Curtis Myson RAC - DG Specialist Western Canada	Office: 780-992-8417 Fax: 780-992-0281 Cellular: 780-619-2763 CURTISM@RAILCAN.CA

IMMEDIATE REPORTING PROVINCIAL AUTHORITY

In the event of an accidental release of dangerous goods, the DGO must make an immediate report to the authority/authorities listed in Exhibit 15 if the release consists of a quantity of dangerous goods that exceeds the quantity set out in Exhibit 14.

Exhibit 14: Quantity of Dangerous Goods Requiring Immediate Reporting

Class	Quantity	Emission Level
1	Any quantity that (a) could pose a danger to public safety or is greater than 50 kg; or (b) is included in Class 1.1, 1.2, 1.3 or 1.5 and is (i) not subject to special provision 85 or 86 but exceeds 10 kg net explosives quantity, or (ii) subject to special provision 85 or 86 and the number of articles exceeds 1 000.	
2	Any quantity that could pose a danger to public safety or any sustained release of 10 minutes or more	
3	200 L	
4	25 kg	
5.1	50 kg or 50 L	
5.2	1 kg or 1 L	
6.1	5 kg or 5 L	
6.2	Any quantity	
7	Any quantity that could pose a danger to public safety	An emission level greater than the emission level established in section 20 of the "Packaging and Transport of Nuclear Substances Regulations."
8	5 kg or 5 L	
9	25 kg or 25 L	

Source: Transportation of Dangerous Goods Regulations Part 8

Exhibit 15: Entities that Must Receive Immediate Reports of an Accidental or Imminent Release of a Dangerous Good

Province	Authority
Alberta	The local police and the appropriate authority at 1-800-272-9600
British Columbia	The local police and the Provincial Emergency Program at 1-800-663-3456
Manitoba	The Department of Conservation at (204) 945-4888 and either the local police of the fire department
New Brunswick	The local police or 1-800-565-1633
Newfoundland	The local police and the Canadian Coast Guard at (709) 772-2083
Northwest Territories	The appropriate authorities at (867) 920-8130
Nova Scotia	The local police or 1-800-565-1633 or (902) 426-6030
Nunavut Territory	The local police and the Nunavut Emergency Services at 1-800-693-1666
Ontario	The local police
Prince Edward Island	The local police or 1-800-565-1633
Quebec	The local police
Saskatchewan	The local police or 1-800-667-7525
Yukon Territory	The appropriate authorities at (867) 667-7244

Source: Transportation of Dangerous Goods Regulations Part 8

REGULATORY REPORTING OF ENVIRONMENTAL INCIDENTS

Separate notification is required by regulation for environmental incidents. The Rail Traffic Center contacts the Environmental Officer (EO) responsible for notifying various municipal, provincial, and government contacts of an environmental incident. Exhibit 16 provides the contact information for such notification.

Exhibit 16: Contact Information for Notification of Environmental Incident

NOC- Network Operations Center	1-780-472-4000	
	Provincial Agency	**Federal Agency**
Alberta	1-(780)-422-4505 1-(800)-222-6514	1-(780)-499-2432
British Columbia	1-(800)-663-3456	1-(604)-666-6100
West Coast Marine Oil Spill Reporting		1-(800)-OILS-911
Manitoba Conservation Environment	1-(204)-944-4888	1-(204)-981-7111
New Brunswick		1-(800)-565-1633
Nova Scotia		1-(800)-565-1633
Ontario / Spill Action Center	1-(416)-325-3000 1-(800)-268-6060	Notified by the Province as required
Saskatchewan Environment Spill Center	1-(800)-667-7525	1-(306)-536-9991
Quebec	1-(866)-694-5454	1-(866)-283-2333
CANUTEC		613-996-6666
Labour Canada		1-800-641-4049
Transportation Safety Board		819-997-7887
Transport of Dangerous Goods Directorate	via CANUTEC	

Any spill that has an effect on the environment must be reported. Dangerous Goods and Environment will determine any actions to be taken.

Annex 1B: Notification - U.S.

All relevant notifications shall be made as per Exhibit 5: Incident Notification Process of the Core Plan.

Exhibit 17: Incident Notification Contacts for CN's US Operations

Contact	Telephone Number
Transportation Supervisor	Location dependent
Regional Operations Center (ROC) Homewood, IL	1-800-585-4967
eBusiness and Transaction Center (ETC)	1-204-470-7928
CHEMTREC	1-800-424-9300
Shipper	24-hour emergency number provided on Waybill
CN Risk Management / Mitigation and Claims	Contacted by CN Police
Dangerous Goods Officer	Contacted by CN Police
Environmental Officer	Contacted by CN Police

Exhibit 18: Other Technical Resources for Spill Response

Contact	Contact Information	
Center for Toxicology and Environmental Health (CTEH) Little Rock, AR		866-869-2834
Transportation Technology Center, Inc. (TTCI) Pueblo, CO	Director	Office: 719-584-0661
Explosive Service International Baton Rouge, LA	**Billy Poe**	Office: 225-275-2152 Home: 225-273-5545 Pager: 225-233-0156 Cellular: 225-603-8984

Exhibit 19: Contacts Required As Conditions Warrant

Contract	Telephone Number
CN Police Communication Center	1-800-465-9239
CN Public Affairs	Contacted by CN Police
National Response Center	1-800-424-8802
Other Federal Agencies	National Response Center – 1-800-424-8802 Environmental Protection Agency (through NRC) Department of Transportation (through NRC) National Transportation Safety Board (through NRC) U.S. Coast Guard Gulf Strike Team (through NRC) Federal Railroad Administration (through NRC)
State and Local Emergency Management Agencies	See Exhibit 19
Municipal Responders	911
Dangerous Goods Officer	Contacted by CN Police
Environmental Officer	Contacted by CN Police
Region 3 of the U.S. Fish and Wildlife Service (covers MN, WI, MI, IO, MO, IL, IN, and OH)	612-713-5301
Region 4 of the U.S. Fish and Wildlife Service (covers KY, TN, AK, LA, MS, and AL)	404-679-7094
Region 6 of the U.S. Fish and Wildlife Service (covers NE)	303-236-7400
Department of Defense	Albuquerque Operations Office – 1-800-541-1625
Department of Energy	Department of Energy Region 5 (serves MI, OH, IN, WI, MN): 630-252-4800 Argonne National Laboratory (serves IL): 630-252-6130 Region 2 Oak Ridge National Laboratory (serves KY, TN, MS, LA): 1-865-576-2900 Region 3 Savannah River Nuclear Facility (serves AL): 803-725-2117

Exhibit 20: State and Local Reporting Contacts

State	Contact	Initial Reporting Requirements
Alabama	Alabama State Police – 334-242-4378	Information not available
	Alabama Department of Public Safety - 334-242-4378	Information not available
	Alabama Dept. of Environmental Management – 334-271-7700	Submit report required by 49 CFR 171.16 to the Department within 14 days of discharge
	Alabama Department of Conservation and Natural Resources - 334-242-3923	Information not available
Arkansas	Arkansas State Police - 501-618-8000	Submit each notice required by 49 CFR §171.15(b) to the State Police
	Arkansas Department of Pollution Control and Ecology (contacted through Arkansas State Police)	Submit copy of written report required by 49 CFR §171.16 and 263.30(c)(2) simultaneously with DOT submission
	Arkansas Department of Natural Resources - 501-301-3100	Information not available
Illinois	Illinois Emergency Management Agency (IEMA) - 1-800-782-7860	Report immediately
	Illinois Commerce Commission - 217-782-4971	Report immediately
Indiana	Indiana Homeland Security - 317-232-3837	Information not available
	Indiana State Emergency Management - 317-232-3830	Information not available
	Indiana Department of Environmental Management 1-888-233-7745	Information not available
Iowa	Iowa Department of Natural Resources - 515-281-8694	Notify within 6 hours of incident, submit written report within 30 days
	Local Police Department or the Office of the Sheriff of the affected county - location dependant	Notify within 6 hours of incident
Kentucky	Kentucky State Fire Marshall – 800-255-2587	Information not available
	Kentucky Natural Resources and Environmental Protection Cabinet – 800-928-2380 / 502-564-2380	Notify within 2 hours of incident, submit written report within 10 days.
	Kentucky Department of Fish and Wildlife Resources - 1-800-858-1549	Information not available
Louisiana	Louisiana State Police/Transportation and Environmental Safety Section – 225-925-6325 (contacts Emergency Response Commission)	Within one hour of the incident, submit written report within 5 days of incident.
	Local Emergency Planning Committee with jurisdiction over the facility – (location dependant)	Upon discovery of incident, submit written report within 5 days of the incident.
	Louisiana Department of Environmental Quality	State police notification will satisfy requirements
	Louisiana Department of Natural Resources - 225-342-4500 (after hours: 225-342-5505)	Information not available
Maine	Emergency Management - 1-207-624-4400	Information not available
Michigan	Michigan State Police - 517-336-6604	Information not available
	Michigan Department of Natural Resources - 517-373-2329	Information not available

Minnesota	Minnesota Dept. of Public Safety - 1-800-422-0798	Information not available
	Minnesota Department of Natural Resources - 651-296-6157	Information not available
Mississippi	Mississippi Emergency Management Agency - 1-800-222-6362	Information not available
	Local Emergency Planning Committee – (location dependent)	Information not available
	Mississippi Department of Natural Resources - 601-965-4339	Information not available
Missouri	Missouri Division of Fire Safety - 573-751-2930	Information not available
	Missouri statewide emergency number (Department of Natural Resources) - 573-634-2436	Up on request, written notifications are required to the Department for substance releases as listed in 40 CFR parts 302 and 355.
	Missouri Department of Natural Resources - 1-800-334-6946	Information not available
Nebraska	Nebraska Department of Environmental Quality (8am-5pm)- 402-471-2186 After hours - notify Nebraska State Patrol	If required by the Department, submit interim reports and a written report within 15 days after remedial action has been completed or within 15 days of the release.
	Nebraska Highway Patrol - 402-471-4545	Information not available
	Nebraska Department of Natural Resources - 402-423-0800	Information not available
New York	Emergency Management - 1-518-292-2200	Information not available
Ohio	Ohio Emergency Management - 614-889-7150	Information not available
	Local emergency planning districts affected by release - (location dependent)	Information not available
	EPA Emergency Response Unit - 1-800-282-9378 or 614-224-0946	Information not available
	Ohio Public Utilities Commission - 1-800-686-7826	Submit written report as required by 49 CFR §171.16
	Ohio Department of Natural Resources - 614-265-6565	Information not available
Pennsylvania	Emergency Management - 1-717-651-2001	Information not available
Tennessee	Tennessee Emergency Management Agency - 1-800-258-3300	Information not available
	Tennessee Department of Environmental Conservation - 615-532-0431	Information not available
Vermont	Emergency Management – 1-800-347-0488 HazMat Incident – 1-800-641-5005	Information not available
Wisconsin	Wisconsin Emergency Management - 1-800-943-0003	Information not available
	Wisconsin Department of Natural Resources - 608-266-7012	Information not available

Regulations Require Five Types of Reporting

The following text describes the specific steps required for immediate and 30-day reporting of a hazardous materials incident. The immediate reporting to federal agencies is done through the National Response Center and the 30-day reporting is done directly to the Department of Transportation.

Immediate Notice of Certain Hazardous Materials Incidents to DOT

At the earliest practicable moment, RTC shall notify the National Response Center (who notifies the Department of Transportation) after each incident that occurs during the course of transportation (including loading, unloading and temporary storage), as required by 49 CFR 171.15, in which:

- A person is killed;
- A person receives injuries requiring his or her hospitalization;
- The estimated carrier or other property damage exceeds $50,000;
- An evacuation of the general public occurs lasting one or more hours;
- One or more major transportation arteries or facilities are closed or shut down for one hour or more;
- Fire, breakage, spillage, or suspected radioactive contamination occurs involving shipment of radioactive material;
- Fire, breakage or spillage or suspected contamination occurs involving shipment of infectious substances;
- There has been a release of a marine pollutant in a quantity exceeding 450 L for liquids or 400 kg for solids; or
- A situation exists of such a nature (e.g., continuing danger to life exists at the scene of the incident) that, in the judgment of the carrier it should be reported to the Department even though it does not meet the criteria addressed above.

Detailed Hazardous Materials Incident Reports to DOT

As required by 49 CFR 171.16, CN shall report in writing to the Department of Transportation within 30 days of the date of discovery, each incident that occurs during the course of transportation (including loading, unloading, and temporary storage) in which any of the circumstances set forth above (for immediate notice of certain hazardous materials incidents) occurs or there has been an unintentional release of hazardous materials from a package (including a tank or any quantity of hazardous waste has been discharged during transportation).

Report of Release Quantities to EPA

At the earliest practical moment, the RTC shall notify the National Response Center (who notifies the Environmental Protection Agency) of all releases that are equal to or exceed the reportable quantity threshold (as required by 40 CFR 302). Reporting guidelines are as follows:

Waybill notation	Report if release exceeds
RQ 1/0.454	1 pound
RQ 10/4.54	10 pounds
RQ 100/45/4	100 pounds
RQ 1000/454	1000 pounds
RQ 5000/22701	5000 pounds

Reporting Incidents Involving DOD Shipments to Albuquerque Operations Office

The RTC should report incidents involving Department of Defense escorted shipments ("White Train") to the Albuquerque Operations Office (1-800-541-1625). CN personnel should not make any other notifications unless directed to do so by the Albuquerque Operations Office, and should not discuss the incident via radio.

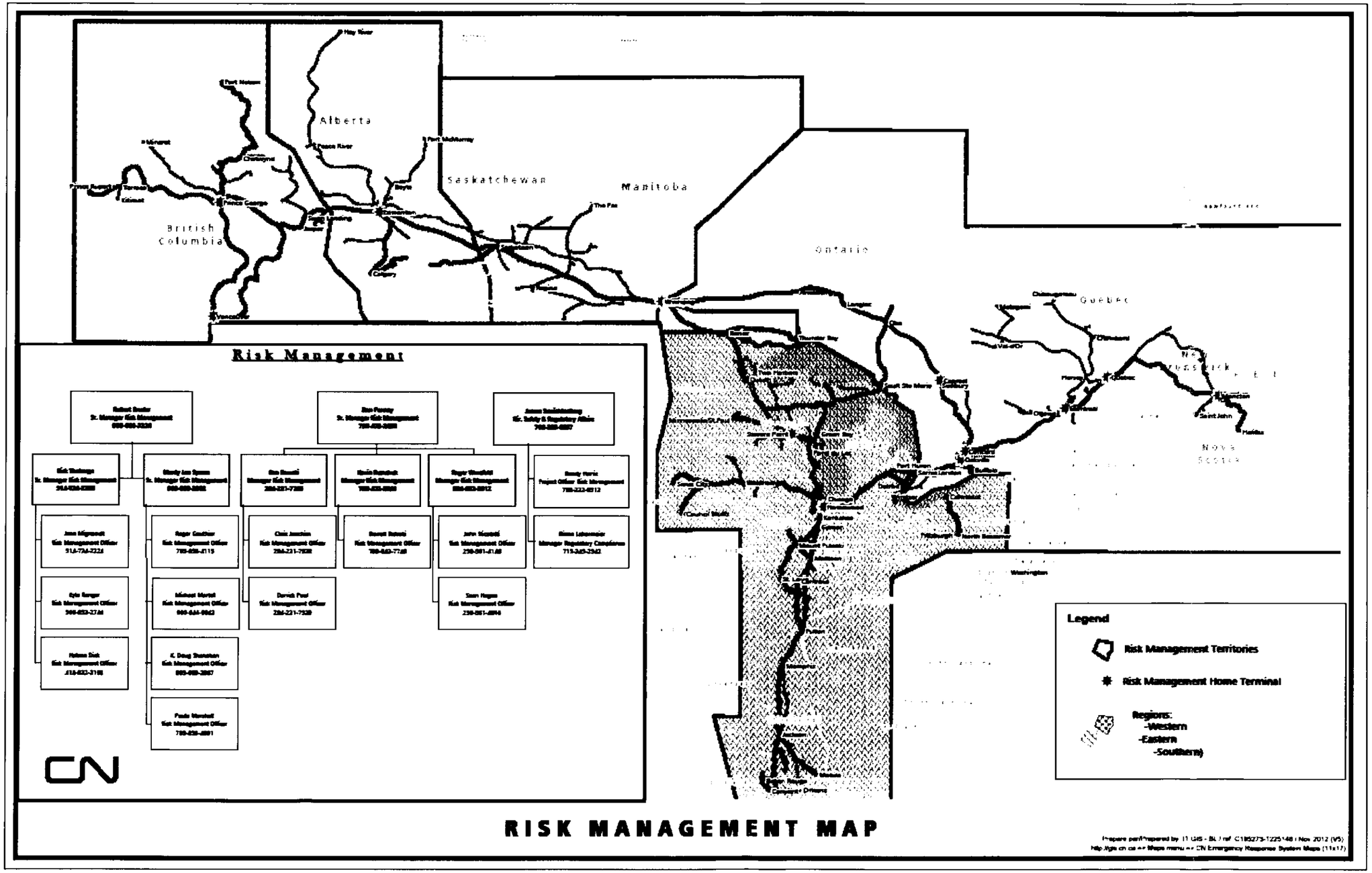
Reporting Incidents Involving Radioactive Materials to DOE

The RTC is responsible for reporting incidents involving radioactive materials to the Department of Energy, as required by 49 CFR 174.750.

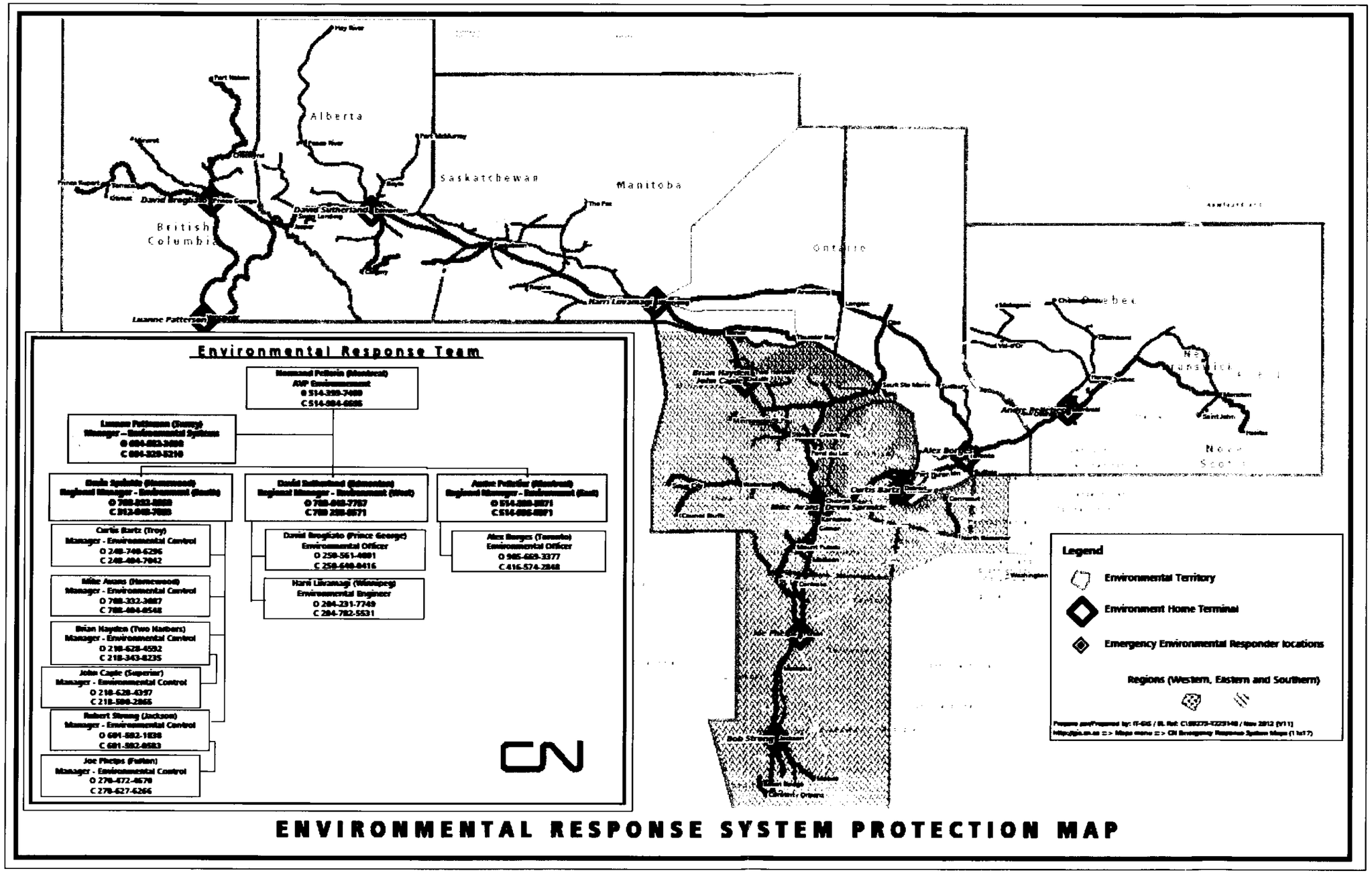
Annex 2: System Protection Maps

This annex contains System Protection Maps identifying responders geographically, including their respective contact information, for the following:

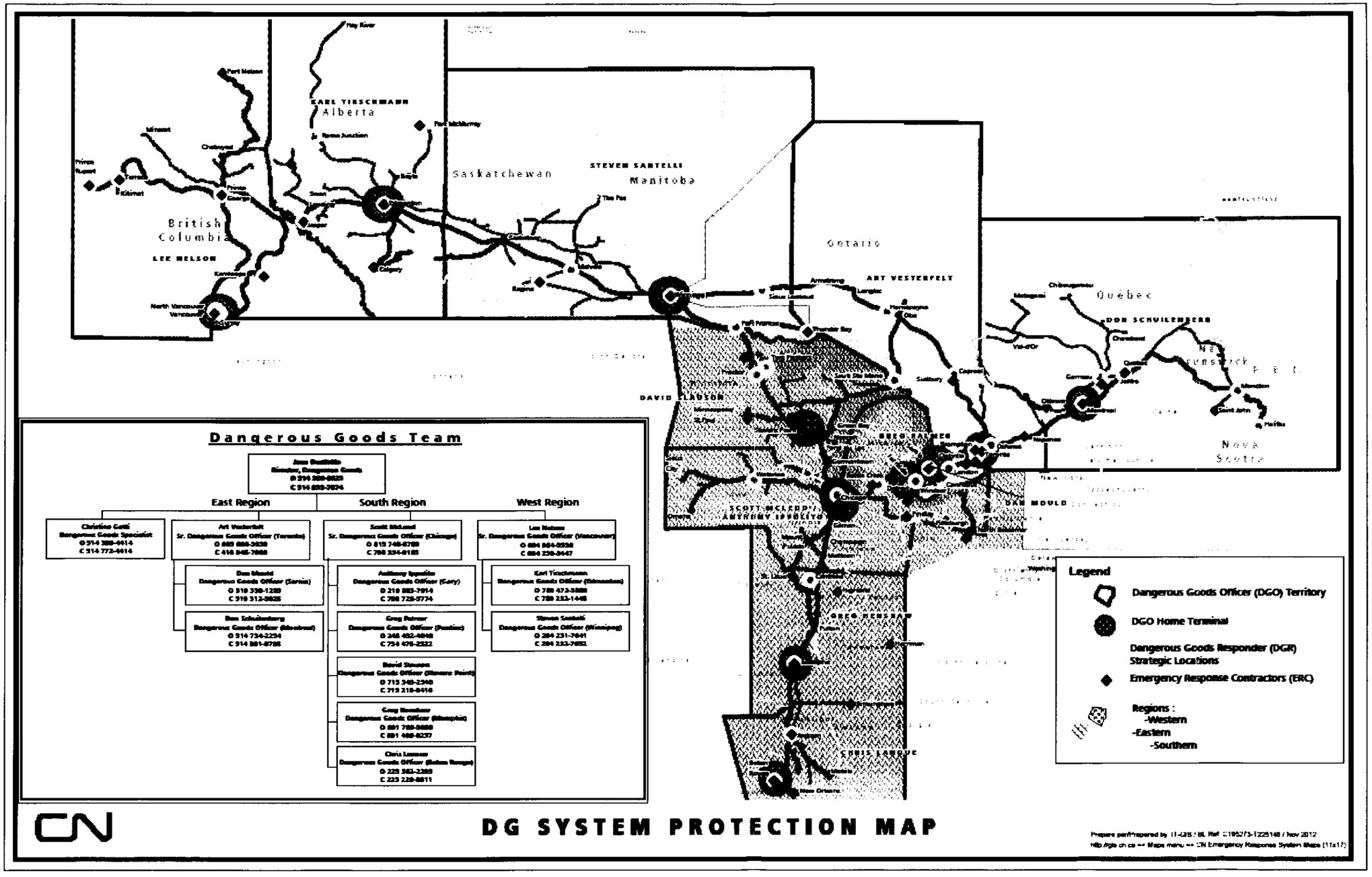
- Risk Management
- Dangerous Goods
- Environment
- CN Police
- Public Affairs
- Risk Mitigation (U.S.)
- Damage Prevention

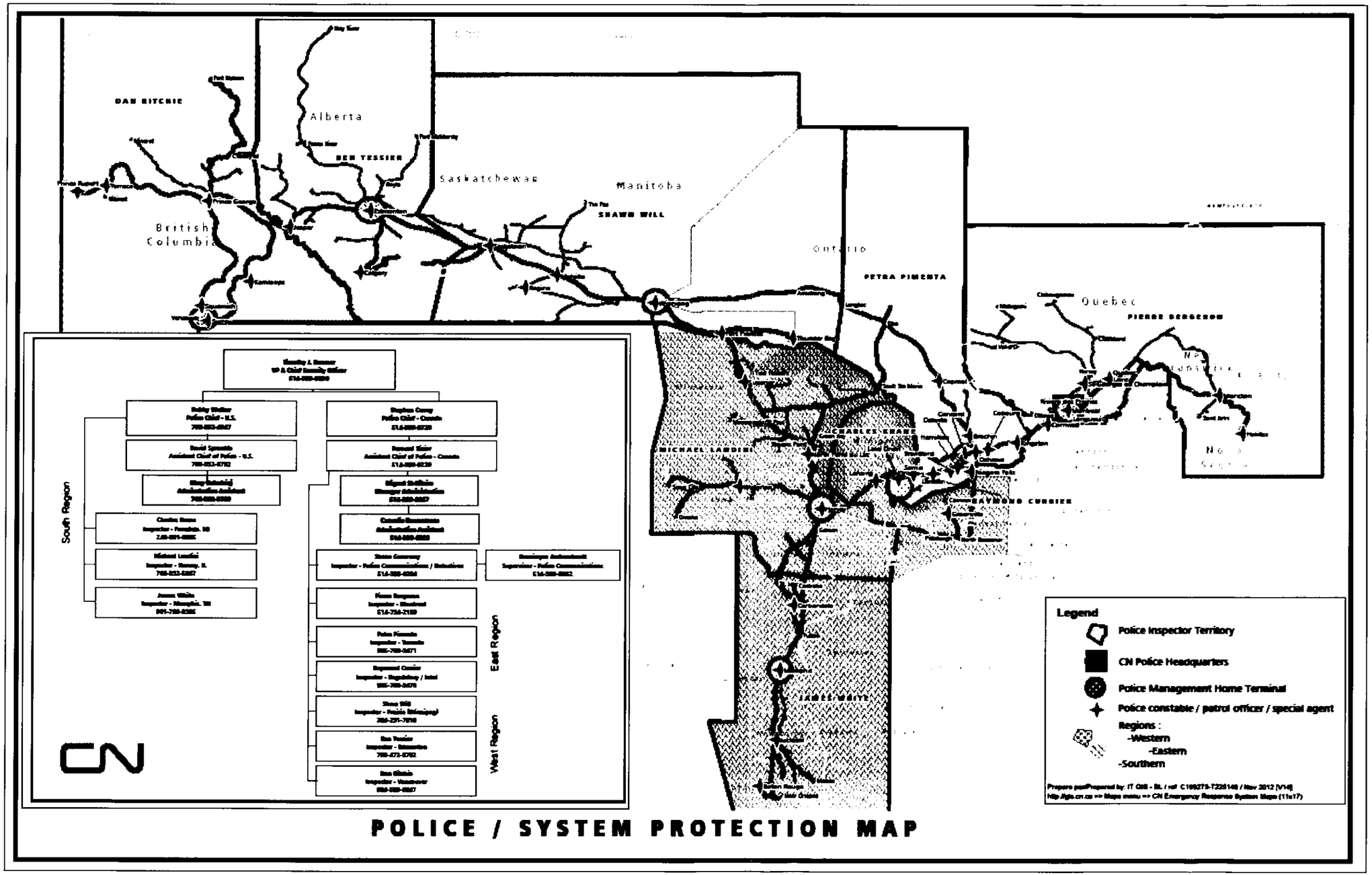


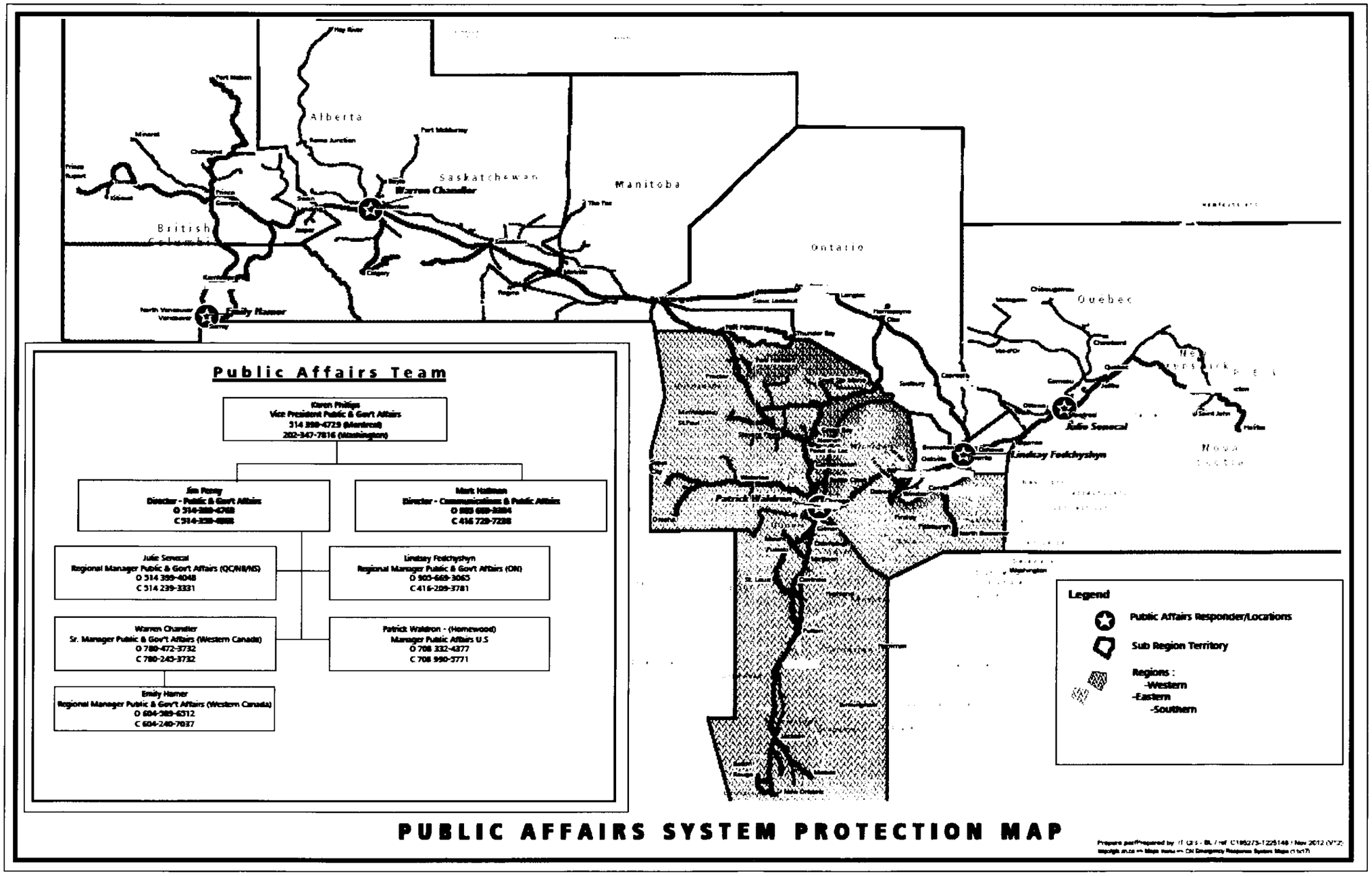
RISK MANAGEMENT MAP

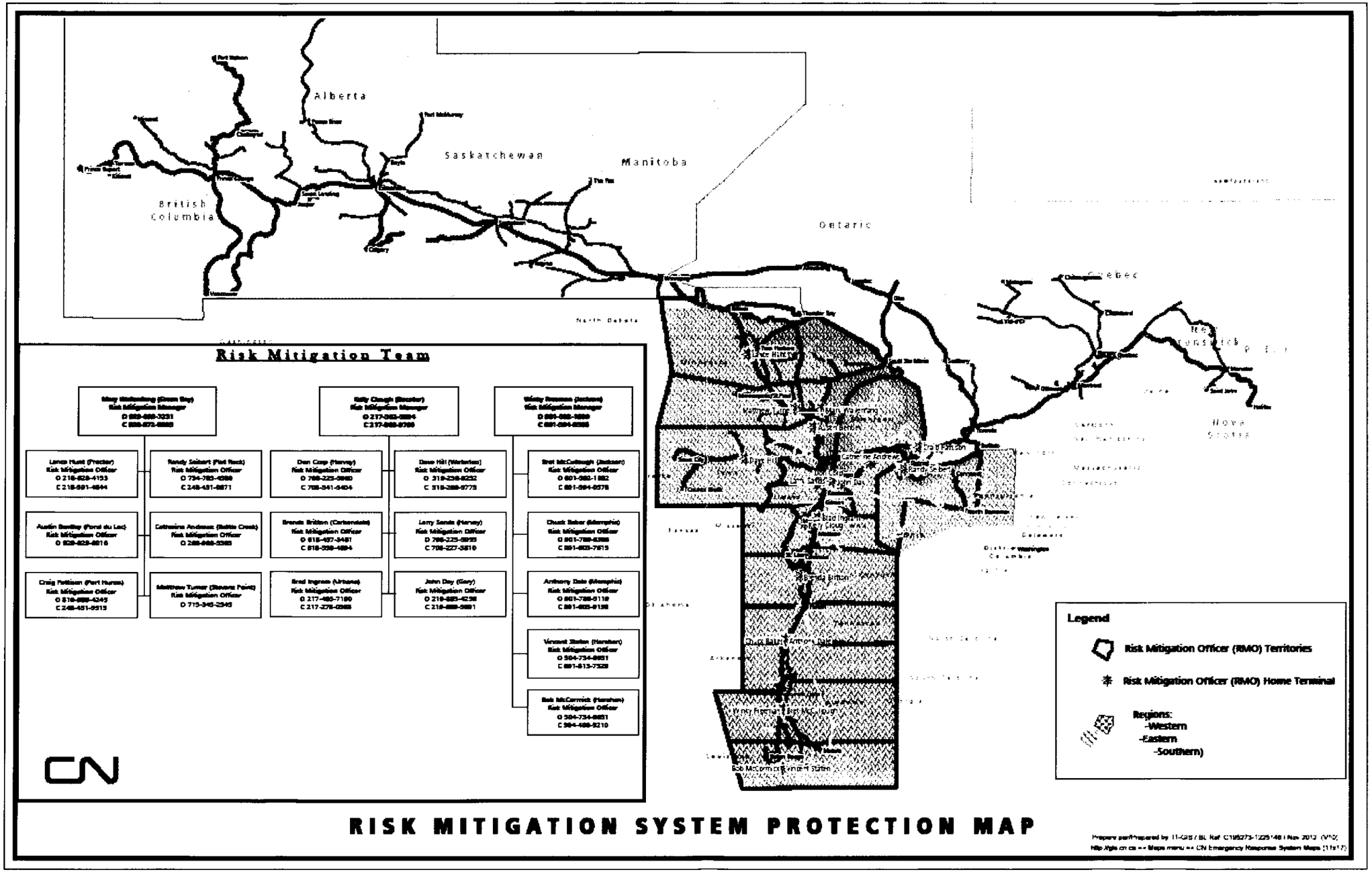


ENVIRONMENTAL RESPONSE SYSTEM PROTECTION MAP

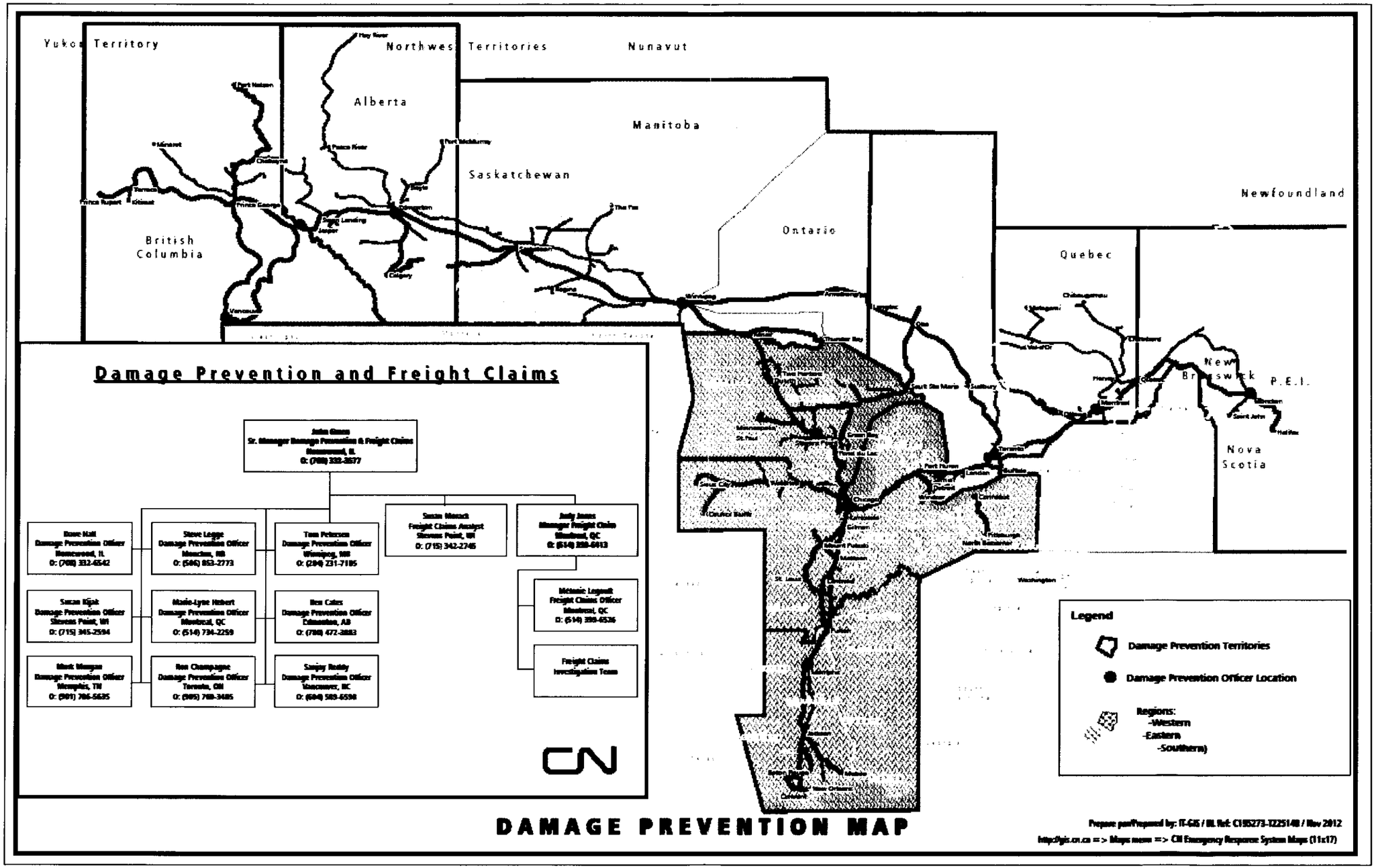

EARL TIRSCHMANN
Alberta
STEVEN SANTELLI
Saskatchewan
Manitoba
British Columbia
LEE NELSON
Ontario
ART VESTERFELT
Québec
DON SCHUILENBERG
DAVID CLAUSON
GREG HENSHAW
SCOTT MCLEOD / ANTHONY IPPOLITO
DAN MOULD
CHRIS LABRUC
Nova Scotia
Dangerous Goods Team
East Region
South Region
West Region
Legend
Dangerous Goods Officer (DGO) Territory
DGO Home Terminal
Dangerous Goods Responder (DGR) Strategic Locations
Emergency Response Contractors (ERC)
Regions :
-Western
-Eastern
-Southern
DG SYSTEM PROTECTION MAP


DAN RITCHIE
Alberta
BEN TESSIER
Saskatchewan
Manitoba
SHAWN WILL
British Columbia
Ontario
PETRA PIMENTA
Quebec
PIERRE BERGERON
CHARLES KRAUSE
MICHAEL LABRIE
RAYMOND CURRIER
JAMES WHITE
South Region
East Region
West Region
Legend
Police Inspector Territory
CN Police Headquarters
Police Management Home Terminal
Police constable / patrol officer / special agent
Regions :
-Western
-Eastern
-Southern
POLICE / SYSTEM PROTECTION MAP


Alberta
Saskatchewan
Manitoba
Ontario
Quebec
British Columbia
Warren Chandler
Emily Hamer
Julie Senecal
Lindsay Fedchyshyn
Patrick Waldron
Public Affairs Team
Karen Phillips
Vice President Public & Gov't Affairs
514 399-4729 (Montreal)
202-347-7816 (Washington)
Jim Penny
Director - Public & Gov't Affairs
O 514-399-4768
C 514-339-4888
Mark Hallman
Director - Communications & Public Affairs
O 888 668-8484
C 416 729-7288
Julie Senecal
Regional Manager Public & Gov't Affairs (QC/NB/NS)
O 514 399-4048
C 514 239-3331
Lindsay Fedchyshyn
Regional Manager Public & Gov't Affairs (ON)
O 905-669-3065
C 416-209-3781
Warren Chandler
Sr. Manager Public & Gov't Affairs (Western Canada)
O 780-472-3732
C 780-243-3732
Patrick Waldron - (Homewood)
Manager Public Affairs U.S
O 708 332-4377
C 708 990-5771
Emily Hamer
Regional Manager Public & Gov't Affairs (Western Canada)
O 604-389-6312
C 604-240-7037
Legend
Public Affairs Responder/Locations
Sub Region Territory
Regions :
-Western
-Eastern
-Southern
PUBLIC AFFAIRS SYSTEM PROTECTION MAP



RISK MITIGATION SYSTEM PROTECTION MAP


Yukon Territory
Northwest Territories
Nunavut
Alberta
Manitoba
Saskatchewan
British Columbia
Ontario
Quebec
Newfoundland
New Brunswick
P.E.I.
Nova Scotia
Damage Prevention and Freight Claims
John Glenn
Sr. Manager Damage Prevention & Freight Claims
Hammond, IL
O: (708) 332-3577
Dave Hall
Damage Prevention Officer
Hammond, IL
O: (708) 332-6542
Steve Legge
Damage Prevention Officer
Moncton, NB
O: (506) 853-2773
Tom Petersen
Damage Prevention Officer
Winnipeg, MB
O: (204) 231-7185
Susan Monack
Freight Claims Analyst
Stevens Point, WI
O: (715) 342-2745
Judy Jones
Manager Freight Claim
Montreal, QC
O: (514) 399-6913
Susan Kipk
Damage Prevention Officer
Stevens Point, WI
O: (715) 345-2594
Marie-Lyne Hebert
Damage Prevention Officer
Montreal, QC
O: (514) 734-2259
Ron Cates
Damage Prevention Officer
Edmonton, AB
O: (780) 472-3883
Mitsonic Legault
Freight Claims Officer
Montreal, QC
O: (514) 399-6536
Mark Morgan
Damage Prevention Officer
Memphis, TN
O: (901) 706-5635
Ron Champagne
Damage Prevention Officer
Toronto, ON
O: (905) 788-3485
Sanjay Reddy
Damage Prevention Officer
Vancouver, BC
O: (604) 589-6598
Freight Claims Investigation Team
CN
Legend
Damage Prevention Territories
Damage Prevention Officer Location
Regions:
-Western
-Eastern
-Southern)
DAMAGE PREVENTION MAP
Prepare par/Prepared by: IT-GIS / BL Ref: C195273-1225140 / Nov 2012
http://gis.cn.ca => Maps menu => CN Emergency Response System Maps (11x17)

Annex 3: Response Management System

This annex describes elements and tools of CN's system for managing responses. The elements and tools include:

Subpart 1. Incident Command System Components and Functions

Subpart 2. Releases of Hazardous Substances that Require an Emergency Response (U.S. only)

Subpart 3. Site Security and Site Management

Subpart 4. Shelter-In-Place Procedures and Places of Refuge

Subpart 5. Personal Protection Equipment

Subpart 6. Decontamination Procedures

Subpart 7. Emergency Medical Treatment and First Aid

Subpart 8. Medical Surveillance and Consultation

Subpart 9. Emergency Alerting and Communications Network Procedures (U.S. Only)

1.0 INCIDENT COMMAND SYSTEM COMPONENTS AND FUNCTIONS

Exhibit 6 illustrates the Incident Command System (ICS) that would most likely be established in the event of a major incident, as discussed in the "Core Plan."

1.1 Command

The individual designated as the Incident Commander has responsibility for all functions. That person may elect to perform all functions, or delegate authority to perform functions to other people in the organization. At the beginning of an incident, the Senior Officer on-site will serve as the Incident Commander. However, as more senior officers arrive to the scene, the Incident Commander position is transferred upward. In addition to the objectives outlined in Section 1.1 of the Core Plan, the following are examples of specific responsibilities that must be performed by the Incident Commander at the scene of an incident:

- Responsible for overall coordination of activities at the scene and will, upon arrival, locate and relieve the operations employee of all coordinating responsibilities, including the taking charge of all pertinent documentation (shipping documents, emergency response information, waybills, etc.).
- Responsible for ensuring that the train is properly protected.
- Responsible for ensuring that proper action is taken to assist injured persons.
- Responsible for ensuring that a log book is established and maintained. The Senior Officer will start the log immediately upon arrival at the scene. The log book will be turned over to the Incident Commander at the command post as soon as it is established, to continue the recording of events.
- Responsible for ensuring that the role normally played by employees is properly carried out.
- Responsible for ensuring that a check is made to determine whether or not hazardous materials are involved and that appropriate action has been taken.
- Responsible for ensuring that effective communications are established and the Network Operations officer, and other officers involved in coordinating the overall activities, are

fully informed as to what has occurred up to that point. The Incident Commander will also arrange timing for future updates.
- In conjunction with the Mechanical and Engineering Branch Directors, responsible for developing an initial plan of operations, including an estimate of when service can be restored. It is imperative that the RTC has an estimate of clearing time as quickly as possible.
- Responsible for ensuring that pertinent information on the traffic involved is relayed to the RTC to permit shipper notification.
- Responsible for assisting the RTC in planning the release of trains when restoration of service is imminent.

In addition to the responsibilities described above, as well as coordination of the primary incident response activities of Operations, Planning, Logistics, and Finance/Administration, the Incident Commander has responsibility for several other important functions. Depending on the size and type of an incident, it may be necessary to designate personnel to handle these additional activities, including:

- **Information Officer** – The Information Officer will be the point of contact for the media, or other organizations seeking information directly from the incident or event. Consistent with CN policy, it is important that all CN personnel involved in environmental incidents not volunteer information, make guesses or estimates, or offer opinions related to the incident unless authorized to do so by the Information Officer. To avoid confusion and ensure consistency of information issued to the public, only the Information Officer, or in his or her absence the Incident Commander, should issue reports to the media.
- **Safety Officer** – The Safety Officer performs a site safety assessment, identifies potential risks, monitors safety conditions and develops measures for assuring the safety of all assigned personnel, including evacuations or sheltering-in-place, if necessary. In addition, when activities are judged by the safety officer to be immediately dangerous to life or health (IDLH) condition and/or involve an imminently dangerous condition, the safety officer has the authority to alter, suspend, or terminate those activities.
- **Liaison Officer** – The Liaison Officer, in the event of a large incident, works with representatives from other agencies or organizations (e.g., mutual aid assistance teams, local fire departments, the Department of Transportation, the shipper) who may be assigned to the incident to coordinate their organization's involvement and resources in the response.

1.2 Planning Section

In ICS, the Planning Section is responsible for managing all information relevant to an incident. The Planning Section collects, evaluates, processes, and disseminates information for use at the incident. There are four branches within the Planning Section that can be activated as necessary:

- **Resources Branch** – responsible for maintaining the status of all assigned resources at an incident;
- **Situation Branch** – responsible for collecting, processing, and organizing all incident information;
- **Demobilization Branch** – responsible for developing the Incident Demobilization Plan; and
- **Documentation Branch** – responsible for maintaining accurate, up-to-date incident files.

1.3 Operations Section

The Operations Section is responsible for managing all tactical operations at an incident. The Operations Section consists of the following components:

- **Dangerous Goods Branch** – responsible for coordinating all aspects of the response involving the source control and containment of hazardous materials. The DGO will serve as the Branch Director. Responsibilities of the DGO include:
  - Supporting the Incident Commander, when appropriate;
  - Interfacing with FRA, NTSB, TC/TDG, and TSB;
  - Handling requests for movement approvals/directions; and
  - Handling hazardous materials documentation.
- **Environmental Protection Branch** – responsible for coordinating all aspects of the response involving the source control and containment of any product that has or is likely to have an environmental impact, as well as providing assessment, remediation, planning, and regulatory liaison activities. Once again, depending on the needs of the incident, the Environmental Protection Branch may be expanded to include the following units:
  - Resource Protection Unit;
  - Environmental Containment Unit; and
  - Remediation Unit.
- **Engineering Branch** – responsible for the re-establishment of plant/track, rebuilding the track, and coordinating arrangement for materials and workforce to perform these tasks.
- **Mechanical Branch** – responsible for the re-railing or clearing of cars throughout the incident and subsequent to the track being re-opened.

1.4 Logistics Section

All incident support needs are provided by the Logistics Section. The Logistics Section is responsible for the following:

- Facilities;
- Transportation;
- Communications;
- Supplies;
- Equipment maintenance and fueling;
- Food services;
- Medical services; and
- Ordering Resources.

On very large incidents, or on incidents requiring a great deal of equipment or facilities, the Logistics Section may be divided into the following branches:

- CN Police;
- Transportation Branch;
- Engineering Branch;
- Mechanical Branch; and
- Other Service and Support Branches, as necessary.

- **CN Police Branch** – responsible for taking all actions and decisions required under the circumstances to save lives, prevent injuries, provide safety to the general public and CN

personnel, and to protect property. A CN Police Inspector will serve as the Branch Director and will be responsible for the following activities, when appropriate:

- Activating the Emergency Alert System, if available on-scene;
- Controlling and, if necessary, dispersing crowds within the emergency area;
- Ensuring the protection of life and property;
- Sealing off the emergency area;
- Controlling traffic to facilitate the movement of emergency vehicles;
- Conducting evacuations in liaison with the Emergency Wardens at the Yard;
- Providing security and preventing looting of evacuated areas on CN property;
- Assisting in search and rescue operations;
- Providing assistance to the coroner;
- Providing or requesting mutual aid when required;
- Acting as a liaison with public police, fire departments, medical services, ambulances, etc.;
- Operating from a command post or alternate command post;
- Maintaining communications with the CN Police Communication Center;
- Investigating jointly with local police departments to establish criminal responsibility; and
- Maintaining a log of all action taken.

- **Transportation Branch** – responsible for re-routing of traffic, monitoring, and declaring the resumption of business services.
- **Other Service and Support Branches** - may be established, if necessary, for the following functions:

  Supply – responsible for ordering, receiving, processing, and storing all incident-related resources;
  Facilities – responsible for set-up, maintenance, and demobilization of all incident support facilities;
  Ground Support – responsible for the maintenance, service, and fueling of all mobile equipment and vehicles;
  Communications – responsible for developing plans for the use of incident communications equipment and facilities; installing and testing of communications equipment; and the distribution and maintenance of communications equipment;
  Food – responsible for supplying the food needs for the entire incident; and
  Medical – responsible for all medical services for incident assigned personnel.

1.5 Finance/Administration Section

The Finance/Administration Section is responsible for managing all financial aspects of an incident. Not all incidents will require a Finance/Administration Section. On some incidents only one Finance/Administration function may be required (e.g., procurement). There are four branches that may be established within the Finance/Administration Section:

- **Time Branch** – responsible for ensuring the accurate recording of daily personnel time, compliance with specific organization time recording policies, and managing commissary operations if established at the incident;
  - **Procurement Branch** – responsible for all financial matters pertaining to vendor, contracts, leases, and fiscal agreements;

- **Compensation/Claims Branch** – responsible for overseeing the completion of all forms required by workers' compensation and local agencies and investigating all claims involving property associated with or involved in the incident; and
- **Cost Branch** – responsible for providing all incident cost analysis.

2.0 RELEASES OF HAZARDOUS SUBSTANCES THAT REQUIRE AN EMERGENCY RESPONSE (U.S. ONLY)

An understanding of the distinction between an incidental release of a hazardous substance and a release that requires an emergency response is fundamental to proper compliance with the provisions of OSHA's HAZWOPER regulations (29 CFR 1910.120(q)).

Potential releases of hazardous substances that may occur along a CN owned main track or yard can be categorized into three distinct groups, which include:

1. Releases that are clearly incidental regardless of the circumstances;
2. Releases that may be incidental or may require an emergency response depending on the circumstances; and
3. Releases that clearly require an emergency response regardless of the circumstances.

2.1 Releases that are Clearly Incidental

An incidental release is a release of hazardous substance, which does not pose a significant safety or health hazard to employees in the immediate vicinity or to the employee cleaning it up, nor does it have the potential to become an emergency within a short time frame. Incidental releases are limited in quantity, exposure potential, or toxicity and present minor safety or health hazards to employees in the immediate work area or those assigned to clean them up.

The HAZWOPER Standard does not require emergency response to incidental releases. An incidental release poses an insignificant threat to health or safety, and may be safely cleaned up by CN employees in the area who are familiar with the hazards of the chemicals with which they are working, as allowed under OSHA Standards.

2.2 Releases that May be Incidental or Require an Emergency Response Depending on the Circumstances

The properties of hazardous substances, such as toxicity, volatility, flammability, explosiveness, corrosiveness, etc., as well as the particular circumstances of the release itself, such as quantity, confined space considerations, ventilation, etc., will have an impact on what CN employees can handle safely and what procedures should be followed. Additionally, there are other factors that may mitigate the hazards associated with a release and its remediation, such as the knowledge of the employee in the immediate work area, the response and personal protective equipment (PPE) at hand, and the pre-established standard operating procedures for responding to releases of hazardous substances contained in the Core Plan.

These considerations (properties of the hazardous substance, the circumstances of the release, and the mitigating factors in the work area) should be combined by the first witness of an incident to determine the distinction between incidental releases and releases that require an emergency response. If necessary, the first witness should consult with more qualified CN employees to determine whether the incident requires an emergency response and an activation of the emergency procedures outlined in the Core Plan.

2.3 Releases that Require an Emergency Response Regardless of Circumstances

There are releases of hazardous substances that pose a sufficient threat to health and safety that, by their very nature, require an emergency response regardless of the circumstances

surrounding the release or the mitigating factors. In these cases, the Emergency Response Plan should be activated and the response procedures outlined in the Core Plan should be followed.

An emergency response includes, but is not limited to, the following situations:

- The response comes from outside the immediate release area;
- The release requires evacuation of employees in the area;
- The release poses, or has the potential to pose, conditions that are immediately dangerous to life and health (IDLH);
- The release poses a serious threat of fire or explosion (exceeds or has the potential to exceed the lower explosive limit or lower flammable limit);
- The release requires immediate attention because of imminent danger;
- The release may cause high levels of exposure to toxic substances;
- There is uncertainty that the employee in the work area can handle the severity of the hazard with the PPE and equipment that has been provided and the exposure limit could easily be exceeded; and
- The situation is unclear, or data are lacking on important factors.

3.0 SITE SECURITY AND SITE MANAGEMENT

Areas surrounding the danger area need to be controlled during emergencies by prohibiting unauthorized personnel from entering pre-established work zones (described below). Emergency responses are coordinated from a command post a safe distance away from the exclusion zone. As described earlier, the CN Police will have responsibility for site security and control and are responsible for taking all actions and decisions required under the circumstances to save lives, prevent injuries, provide safety to the general public and CN personnel, and to protect property within the CN right-of-way. However, in many cases, the local emergency police department may be the first to arrive on-scene and will have begun site security and management operations prior to the arrival of the CN Police. In these cases, the CN Police will cooperate with the local police department personnel and assist in site security and management as directed. The CN Police are also responsible for more specific activities, which are outlined in subpart 1.4 of this Annex.

For major incidents, CN Police will control site security using the Emergency Access Pass System. This system employs plasticized cards with the corresponding CN Region and CN Police logo. Cards are marked with the heading "Emergency Pass" and are individually numbered. There are eight (8) different coloured passes corresponding to each of the following groups: Employees, Police/Fire, Contractors, Provincial, Municipal, Federal, Media and Security.

The card number is entered in a control sheet for each person with the following information: time in/out, date, zone, phone number and colour of pass.

The pass holder is instructed to return the pass to the control centre when departing.

This process was developed to control the number of people in the site. CN Police will monitor the site to ensure everyone has been issued such a pass which has been logged into the Control Sheet. Persons found without a pass will be required to sign in and wear such a pass visibly at all times.

CN Police or their designate maintain control at all times.

3.1 Command Post

Along with other senior officials from each response agency represented at the scene of an incident, CN response personnel will establish a temporary command post (e.g., emergency response vehicle, house, building) at each emergency site immediately upon arriving at the

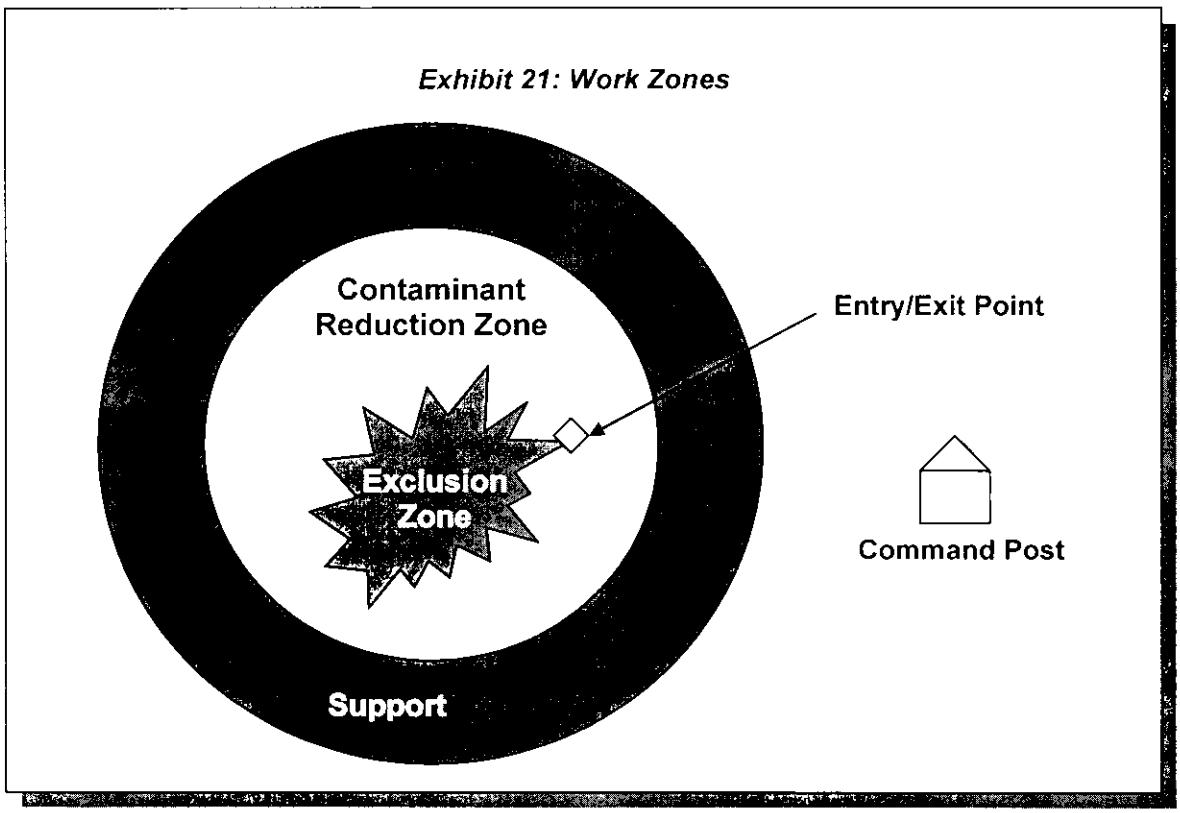
emergency. The temporary command post will be replaced by an appropriate mobile or fixed command post as determined by the Incident Commander, who will also establish an overall command post. All interagency communications will be channeled through this command post and direct on-line (radio or telephone) will be established with the appropriate entities (e.g., RTC).

3.2 Work Zones

Work zones control the movement of personnel and equipment within the contaminated area to small areas of the site to minimize the spread of contaminants. As illustrated in Exhibit 20, typically, three contiguous work zones are recommended:

1. Exclusion Zone (e.g., "Hot Zone");
2. Contaminant Reduction Zone (e.g., "Warm Zone"); and
3. Support Zone (e.g., "Cold Zone").

Exhibit 21: Work Zones



3.2.1 Exclusion Zone

The exclusion zone is the innermost of three concentric areas and is where contamination is located. All personnel entering the zone must wear appropriate protective gear and be accompanied by another trained responder. An entry and exit point must be established at the periphery of the Exclusion Zone. Personnel expected to set up the exclusion zone must be trained to the first responder operations level. Once the exclusion zone is set, employees (preferably trained to the first responder awareness level) may control entry and exit in the area. An employee trained to the first responder awareness level may not set up safe distances

because they lack knowledge regarding potential of exposure, explosion, or radiation. Examples and exceptions include:

(1) An employee trained to the first responder awareness level could assist in preventing unauthorized entry into an emergency release area; while

(2) An employee trained to first responder operations level could not set up the exclusion zone to determine how close to the accident cars should be permitted to drive; and

Personnel, not necessarily CN's own employees, who are skilled in the operation of certain equipment, such as mechanized earth moving or digging equipment, and who are needed temporarily to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by CN's own employees, are allowed into the exclusion zone temporarily and are not required to meet the training required by HAZWOPER, but are required to wear appropriate PPE and receive a health and safety briefing.

3.2.2 Contaminant Reduction Zone

A Contaminant Reduction Zone is located between the Exclusion Zone and the Support Zone, and provides a transition zone between the contaminated and clean zones. Most decontamination is performed within this zone.

3.2.3 Support Zone

The Support Zone is considered an uncontaminated area and is used for staging equipment to be used in cleanup activities. Traffic in the support zone is restricted to authorized personnel. No contaminated clothing or equipment are allowed within this area.

3.3 Organization of Workers Using the Buddy System

When carrying out activities in the Exclusion Zone, workers shall use the buddy system to ensure that rapid assistance can be provided in the event of an emergency. The buddy system is an approach used to organize workers into workgroups so that each worker is designated to be observed by at least one other worker. While work is being performed in the Exclusion Zone, two responders must be in the Zone and two responders must be out of the Zone to carefully monitor the safety of the workers in the Zone.

The Incident Commander is responsible for enforcing the buddy system and should implement the system at the Access Control Point for personnel entering the Exclusion Zone.

Workers in the buddy system should remain close together and maintain visual contact with each other to provide assistance in the event of an emergency. Should an emergency situation arise, workers should use the communication signals established and agreed upon prior to entering the contaminated area.

The responsibilities of workers utilizing the buddy system include:

- Providing his or her partner with assistance;
- Observing his or her partner for signs of chemical or heat exposure;
- Periodically checking the integrity of his or her partner's personal protective equipment; and
- Notifying the site manager or other site personnel if emergency assistance is needed.

Workers should not rely entirely on the buddy system to ensure that help will be provided in the event of an emergency. To augment this system, workers in contaminated areas should remain in line-of-sight or communication contact with the command post or site manager at all times. In

addition to the use of the buddy system to ensure enhanced safety, back-up personnel will also stand by with equipment ready to provide assistance or rescue.

4.0 SHELTER-IN-PLACE PROCEDURES AND PLACES OF REFUGE

As indicated in the Core Plan, it is CN's decision to evacuate personnel at any of its yards or on a main track and CN may assist in simultaneously notifying nearby businesses and the community. However, it is the decision and responsibility of local authorities (e.g., police and fire departments) to initiate protective actions, such as evacuations, for the community outside a yard or outside the right-of-way of a main track.

If the decision is made to shelter-in-place, CN employees will be directed to take the following steps:

- Seek shelter in the closest permanent building or rail car, as applicable;
- Account for all persons in the structure;
- Close off all ventilation (e.g., air conditioning, furnace, windows, air intake);
- Stay inside the structure until an "all clear" announcement is made by the supervisor or Incident Commander; or
- If you are outside and cannot reach a shelter, get into the closest vehicle and close off all ventilation.

5.0 PERSONAL PROTECTIVE EQUIPMENT

The purpose of personal protective clothing and equipment (PPE) is to shield or isolate individuals from the chemical, physical, and biologic hazards that may be encountered at a hazardous substance site. No single combination of protective equipment and clothing is capable of protecting against all hazards. Thus, PPE should be used in conjunction with other protective methods and its effectiveness evaluated periodically. CN site personnel must wear appropriate personal protective clothing and equipment whenever they are near the site. At dangerous goods incidents, selection of the appropriate level of chemical protective clothing and respiratory protection should be made by the DGO or a dangerous goods qualified person. Selection of other appropriate PPE is a complex process that should take the following factors into consideration:

- Material Safety Data Sheet (MSDS) of the product(s) on the site, use CCHOS website:

  http://ccinfoweb.ccohs.ca/msds/search.html

- Identification of the hazards or suspected hazards;
- Potential exposure routes (e.g., inhalation, skin absorption); and

The performance of the PPE materials and seams in providing a barrier to these hazards. When deemed necessary for meeting the tasks at hand, approved self-contained breathing apparatus (SCBA) may be used with approved cylinders from other approved self-contained breathing apparatus provided that such cylinders are of the same capacity and pressure rating. The following subparts provide a brief description of each PPE level, when it is required, and the equipment comprising the level.

5.1 Level A

Level A protection is required when the greatest potential for exposure to hazards exists, and when the greatest level of skin, respiratory, and eye protection is required. The following are examples of appropriate Level A equipment:

- Positive pressure full face-piece SCBA or positive pressure supplied air respirator with escape SCBA;
- Totally encapsulating, vapor tight chemical-protective suit;
- Inner and/or outer chemical resistant gloves; and
- Disposable protective suit, gloves, and boots.

5.2 Level B

Level B protection is required under circumstances requiring the highest level of respiratory protection, with a lesser level of skin protection. Potential Level B equipment includes:

- Positive pressure, full face-piece SCBA or positive pressure supplied air respirator with escape SCBA;
- Inner and/or outer chemical resistant suits;
- Coverall;
- Other chemical-resistant boots; and
- Inner/outer gloves.

5.3 Level C

Level C protection is required when the concentration and type of airborne substances is known, and the criteria for using air purifying respirators are met. Typical Level C equipment includes:

- Full-face or half-face air-purifying respirators with appropriate eye protection;
- Inner and outer chemical-resistant gloves;
- Hard hat;
- Chemical resistant suit; and
- Disposable chemical-resistant outer boots.

5.4 Level D

Level D is the minimum protection required. Appropriate Level D protective equipment may include:

- Gloves;
- Coverall;
- Safety glasses;
- Face shield; and
- Chemical-resistant steel-toe boots or shoes.

6.0 DECONTAMINATION PROCEDURES

All personnel, clothing, equipment, and samples leaving the Exclusion Zone must be decontaminated to remove any harmful chemicals or infectious organisms that may have adhered to them. Three general types of decontamination methods are commonly used:

1. Physical removal of contaminants;
2. Inactivation of contaminants by chemical detoxification or disinfection/sterilization; or
3. A combination of both physical and chemical means.

In general, CN response personnel will not be responsible for decontamination except for minor incidents. CN does not have access to advanced decontamination equipment or resources and will primarily only use decontamination methods that involve the physical removal of contaminants (as described below). For more advanced decontamination procedures (e.g., chemical removal of contaminants), CN response personnel will rely on the Local Emergency Response Agencies (e.g., Fire, EMT), the shipper, or the shipper's response/cleanup contractor to perform the necessary procedures.

6.1 Physical Removal of Contaminants

In many cases, contaminants may be removed by physical means; however, high pressure and/or heat should be used only as necessary and with caution because they can spread contamination and cause burns. Some contaminants that can be physically removed are described below.

- **Loose Contaminants** – Soils or dusts that cling to equipment and personnel or that become lodged in PPE materials can be removed with water or a liquid rinse. Commercially available anti-static solutions may help to remove electrostatically attached particles.
- **Adhering Contaminants** – Some contaminants adhere by forces other than electrostatic attraction. Adhesive qualities vary greatly with the specific contaminants such as glues, cements resins, and muds have great adhesive properties and, consequently, are difficult to remove by physical means. Adhesive contaminants can be removed using methods such as solidification, freezing (e.g., using dry ice or ice water), adsorption or absorption (e.g., with powdered lime or kitty litter), or melting.
- **Volatile Liquids** – Volatile liquid contaminants can be removed from protective clothing or equipment by evaporation (using steam jets) followed by a water rinse. This method should be used with caution because of the potential for employees to inhale the vaporized hazardous chemicals.

6.2 Chemical Removal of Contaminants

As stated in section 6.0, chemical removal of contaminants should only be performed with expert guidance.
Physical removal of gross contamination should be followed by washing and rinsing with cleaning solutions. These solutions normally use one or more of the following methods:

- **Dissolving Contaminants** – Chemical removal of surface contaminants can be accomplished by dissolving them in a solvent that must be chemically compatible with the equipment being cleaned. This is particularly important when decontaminating personal protective clothing constructed of organic materials that could be damaged or dissolved by organic solvents. In addition, any flammable or toxic organic solvent must

be used and disposed of cautiously. Organic solvents include alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products.

- Halogenated solvents are toxic and generally are incompatible with most types of PPE. They should be used only for decontamination in extreme cases where other cleaning agents will not remove the contaminant. Because of the potential hazards decontamination using chemicals should be done only if recommended by an industrial hygienist or other qualified health professional.
- **Surfactants** – Surfactants supplement physical cleaning methods by minimizing adhesion between contaminants and the surface being cleaned and, therefore, prevent recontamination. Among the most common surfactant are household detergents, some of which can be used with organic solvents to improve the dissolving and dispersal of contaminants into the solvent.
- **Rinsing** – Rinsing removes contaminants through dilution, physical attraction, and solubilization. Multiple rinses with clean solutions remove more contaminants that a single rinse with the same volume of solution. Continuous rinsing with large volumes is the most effective way to remove contaminants.
- **Disinfection/Sterilization** – Chemical disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization techniques are generally impractical for large equipment and PPE. For this reason, Disposable PPE is recommended for use with infectious agents.

7.0 EMERGENCY MEDICAL TREATMENT AND FIRST AID

When rescue and/or medical aid is necessary during an emergency situation, generally, CN will depend on the Local Emergency Response Agency (Police, Fire, EMT). The responding Local Emergency Response Agency will be responsible for performing rescue duties in case of an emergency requiring rescue. The Local Emergency Response Agency responding in an emergency will help with and direct all rescue and medical duty assignments upon their arrival to the incident site.

8.0 MEDICAL SURVEILLANCE AND CONSULTATION

This section is written with reference to US regulations, however similar principles are applicable in Canada.
CN provides OSHA mandated medical surveillance and consultation to all members of the Hazardous Material Team and hazardous material specialists. The determination of who is required to receive a physical is determined by the CN Risk Management Department and coordinated though the CN Medical Department based on the requirements stated in 29 CFR 1910.120(f)(2). The following is a list of the types of employees requiring medical monitoring by CN.

- All members of the Hazardous Materials Team.
- Employees who are or may be exposed to a hazardous substance either at or above the Permissible Action Limits.
- Employees who wear a respirator more than 30 days a year.
- Employees who are either injured or ill or develop signs and symptoms due to an exposure.

After determining who is required to receive a physical per 29 CFR 1910.120(f)(2), the frequency of the physical needs to be determined. This requirement is stated in 29 CFR 1910.120(f)(3) and includes the following criteria:

- Prior to assuming any position, which may allow for an exposure to any hazardous substances.
- At least every twenty four (24) months.
- On leaving CN or being reassigned to a job which is not covered by 29 CFR 1910.120(f).
- Following the notification by an employee that they have been injured, developed signs and symptoms which may be from an overexposure to a hazardous substance or has been involved in an overexposure above the permissible exposure limit.

The Medical Department will determine what specific tests and procedures shall be included in the examination. The components of the physical examination can include some or all of the following.

- A routine physical
- Pulmonary function test
- Chest x-ray
- Electrocardiogram (ECG)
- Blood test
- Urine test

All employee medical records and documentation will be kept for a period of employment plus 30 years as required by 29 CFR 1910.1020(d)(i). All of the physicals, medical testing and medical consultations shall meet the requirements as stated in 29 CFR 1910.120(f).

9.0 EMERGENCY ALERTING AND COMMUNICATING NETWORK PROCEDURES (U.S. ONLY)

A communication system must be established for both internal and external communication. Internal communication refers to communication between workers operating in the Exclusion Zone, or to communication from the command post to these workers. Internal communication is generally used to:

- Alert team members to emergency situation;

- Convey safety information (e.g., air time remaining in SCBA, heat stress check, hazards detected);
- Communicate changes in the work to be accomplished; and
- Maintain site control.

The CN Incident Commander will designate an employee to initiate internal communications will use the method identified for internal communication at the specific site. CN would use radios and cellular phones for emergency communications.

External communication refers to communication between onsite and offsite personnel. An external communication system must be maintained in order to:

- Coordinate emergency response efforts with offsite responders;
- Report progress or problems to management; and
- Maintain contact with essential offsite personnel.

DETAILED ALARM PROCEDURES FOR ALL CN OWNED TERMINALS AND YARDS CAN BE FOUND IN THE SITE-SPECIFIC EMERGENCY ACTION/PREPAREDNESS PLANS.

Annex 4: Emergency Response Training and Exercises

This annex outlines CN's approach to training and exercises. This approach is designed to ensure that all CN personnel take appropriate protective actions, understand the response system, and are capable of conducting appropriate response actions.

1.0 TRAINING

CN will schedule employee training on a regular basis to ensure employee familiarity with procedures and responsibilities in the event of an emergency. There are four basic categories of emergency response training for CN personnel:
Level 1 - All personnel who have the potential to use this plan receive CN's on-line Emergency Response Plan Awareness Course. Refresher training shall be of sufficient duration and content so as to continuously demonstrate competency.

Level 2 - All personnel who function in the capacity of an Incident Commander or function as the Senior CN Officer at an emergency receive CN's Railroad Emergency Response and Incident Command System 100 (ICS 100) courses. Refresher training shall be of sufficient duration and content so as to continuously demonstrate competency. Level 2 responders shall meet the training requirements outlined in Level 1.

Level 3 - All personnel functioning in a Dangerous Goods Responder (DGR) capacity receive hazardous materials training based on National Fire Protection Association (NFPA) standard 472. Refresher training shall be of sufficient duration and content so as to continuously demonstrate competency. Level 3 responders shall meet the training requirements outlined in Levels 1 and 2.

Level 4 - All personnel functioning in a Dangerous Goods Officer (DGO) capacity receive hazardous materials technician, tank car specialist, inter-modal specialist and incident command training commensurate with National Fire Protection Association (NFPA) standard 472. Refresher training shall be of sufficient duration and content so as to continuously demonstrate competency. Level 4 responders shall meet the training requirements outlined in Levels 1, 2, and 3.

2.0 SKILLED SUPPORT PERSONNEL (U.S. Only)

This classification of personnel includes employees of contractors of CN whose normal job duties do not include hazardous waste operations and emergency response to chemical releases or accidents. Because they are not employees of CN, they are not required to meet any specific training requirements of CN. These people have training and skills in operating equipment, such as cranes, lifting devices, earth moving and digging equipment, that is needed to perform emergency support actions to control the incident. Examples would be heavy equipment operators and riggers. CN relies on subcontractors to furnish properly trained personnel and provide a synopsis of training for each employee working on CN operations. The synopses shall contain all initial and refresher training, medical surveillance status, respiratory

protection training and certification and any other training they have received that is required under OSHA and DOT requirements.

These skilled support personnel will be permitted to perform their special skills following an initial briefing by CN Railroad personnel. The initial briefing shall include:

- Instruction on wearing and use of appropriate personnel protective equipment;
- What chemical hazards are involved;
- What duties are they to perform; and
- Appropriate safety and health precautions.

3.0 SPECIALIST EMPLOYEE (U.S. Only)

A specialist employee is an employee of CN who works with and is trained in the hazards of specific hazardous substances as part of their regular job. These employees may be called on to provide technical assistance or advice at a hazardous substance release. An example of the position that would fall into this category would be an Industrial Hygienist. Employees in this category will either receive training or demonstrate competency in their area of expertise.

4.0 TRAINERS (U.S. Only)

CN ensures that all instructors and organizations that teach any coursework related to hazardous substance releases and response, possess the proper instructor certifications for the courses they are instructing. For those who do not possess the proper teaching certifications, they must have sufficient training, education, knowledge, and experience in the subject matter and instructional experience to demonstrate competency.

5.0 REFRESHER TRAINING (U.S. Only)

CN shall ensure that any employee receiving training in hazardous substance releases and responses shall receive annual refresher training. This training shall be such to maintain competency in their knowledge and skills. This training is either conducted by members of the CN staff in-house or outsourced to various locations across the United States

6.0 DRILLS AND EXERCISES

CN will conduct periodic exercises with CN and non-CN response personnel to ensure necessary personnel are familiar with this emergency response plan.
A response critique will be conducted at the conclusion of each drill or exercise to identify areas for improvement and a schedule for their implementation.

Annex 5: References

This Annex lists references that may be of value in the event of an emergency.

- CN Environmental Incident Response and Communication, EMP No. 2
- CN Environmental Emergency Response, EMP No. 3
- CN Dangerous Goods Air Monitoring Protocol (CNDGAMP)
- CN Security Management Plan. CN Police
- Terrorism Emergency Response Plan. CN Police
- Earthquake Response Procedures. CN Engineering
- Weather Protocols. CN Engineering
- Critical Incident Response. CN Human Resources
- Business Continuity Plans. CN Functional
- CN Intranet: http://cninet.cn.ca/en/index.asp
- CN Environment Home: http://cninet.cn.ca/environment/index.html
- CN Safety and Regulatory Affairs:

  http://cninet.cn.ca/SafetyRegulatoryAffairs/web/en/index.html

Annex 6: Environment Canada Storage Tank Regulations

This Annex addresses requirements in Environment Canada Storage Tank Regulation SOR/2008-197.

CN stores gasoline, diesel and engine oil in storage tanks on company property in accordance with EC regulations. A complete list of the locations and capacities of these storage tanks can be found in CN's SAP system.

A typical facility where the storage tank resides is within a rail yard or siding, where there are continuous train movements on the tracks. There are buildings, mechanical shops and roadways that run along and over rail tracks. Extreme caution must be observed when driving within the limits of the rail yard and all traffic signs and signals must be respected while paying special attention to train movements. Specific sensitivity data can found in E2MS which is accessible by CN Environment, ER Responders and Environment Canada.

MSDS sheets for products stored in these tanks can be found in the MSDS database on the CN intranet. The general properties and characteristics of the products are found in the table below, for detailed product information the MSDS sheet must be consulted.

Product	Properties and Characteristics
Diesel Fuel No.2	Physical State: Liquid Colour: Colourless (may be dyed red, light green or yellow) Odour: Petroleum
Gasoline	Physical State: Volatile Liquid Colour: Colourless Odour: Typical gasoline odour Odour Threshold: < 0.25 ppm
Engine Oil	Physical State: Liquid Colour: Amber Odour: Characterisitc Odour Threshold: N/D

CN Emergency Response Plan
Petroleum Storage Tanks Section

Yard Name and Location: _____

Introduction

This section provides additional information to the CN Emergency Response Plan (ERP) pertinent to the **"Storage Tank Systems for Petroleum Products and Allied Petroleum Product Regulation"** of Environment Canada (EC). Implementation of measures to ensure worker and public safety or, if necessary, notification of the general public will be supervised by the CN Police, as per the ERP. The detailed response process in case of a spill or an accident is presented in the ERP and applies to any quantity spilled.

Site Specific Emergency Response Plan

The ERP can be made site specific by adding the name and location of the facility in the appropriate section above.

Nature of the product

Petroleum products or allied petroleum products are lighter than water and consequently will float on water. They must be treated as flammable liquids and all sources of ignition must be kept away during handling or spill response.

In Case of a Spill – Initial Response:

The steps to follow in case of a spill are detailed on the page titled **"What should I do when a spill occurs"**. Depending of the magnitude of the spill, the weather and the specific site conditions, the response steps can be implemented in a different order as conditions warrant. Above that, the health and safety of CN personal and the public must always be the primary concern. Spill response material is usually available in the tank area or at specified locations.

Response/Prevention

Roles and responsibilities of responders are described in section 2.1.2 of the CN Emergency Response Plan and the CN key responders by Region are presented in Annex 2.
A copy of the ERP must be available in the yards where tanks are in service. For tanks located in remote locations, the document **"What should I do when a spill occurs"** should be posted on the tank in replacement of the ERP.

Training

No specific training is required for the initial responders. However, CN Environment provides regular training on spill response and employees are encouraged to participate. Training can also be provided on request. If an initial responder is unsure of what actions to take pertaining to the hazards at hand, he or she must never put themselves at risk and immediately escalated the issue. Authorized, specialized contractors will be mobilized for significant clean-up.

WHAT SHOULD I DO WHEN A SPILL OCCURS?

1. ***Stop the leak, if safe to do so.***

Shut off pumps, close valves, and block drains.

2. ***Eliminate sources of fire.***

Cut the electricity and turn off sources of ignition. Extinguish any flames.

3. ***Secure the area.***

Restrict access to the spill area and set up a secured zone.

4. ***Contain the spill.***

Use your spill kit, peat moss, sand, snow, etc.

5. ***Prevent seepage of the product***

Prevent from entering watercourses, storm, drains, sewer systems, etc.

Use plastic tarps or other materials to build a retention pond.

6. ***Advise Supervisor, CN Police, and Environmental Officer***

CN POLICE 1-800-465-9239

7. ***Site Remediation***

Dispose of any contaminated material in secured, labelled containers (drum, Hazmat buildings, etc.)

8. ***Media***

Refer the media to CN Public Affairs.

9. ***Spill Report***

Document the spill event in SAP's Incident / Accident log.

10. ***Refill the spill kit***

Refer to SRM for new materials.

SECTION 4: SITE-SPECIFIC SUPPLEMENTS

Site-specific supplements can be found at the following CN intranet location:

http://cninet.cn.ca/SafetyRegulatoryAffairs/web/en/index.html

Then select "Emergency Response Plan" and browse by region.

SECTION 5: LIST OF EMERGENCY CONTRACTORS

We will employ third party resources as required to meet the needs of the incident.



APPENDIX B

ABBREVIATED SYSTEM INSPECTION FORM

LOCAL PERSONNEL
WEEKLY ENVIRONMENTAL PROTECTION SYSTEM INSPECTION
HORNEPAYNE YARD, HORNEPAYNE, ONTARIO

Inspector: Date:
Weather:

WEST END

1.0 Skimmer/Waste Oil Recovery Tank

1.1	Is system operational?	YES/NO
1.2	Clean wiper blades.	_____
1.3	Measure depth to product in waste oil tank (m).	_____
1.4	Measure depth to water in waste oil tank (m).	_____

2.0 Diesel Recovery Lagoon/Effluent Discharge

2.1	Any product in Lagoon No. 5?	YES/NO
2.2	At which end of lagoon is product located?	_____
2.3	Any sheen/product being discharged to Jackfish River?	YES/NO

EAST END

1.0 Compressor/OWS/Waste Oil Recovery Tank

1.1	Is system running?	YES/NO
1.2	Drain tank on compressor.	_____
1.3	Measure depth to product in waste oil tank (m).	_____
1.4	Measure depth to water in waste oil tank (m).	_____
1.5	Any sheen on Jackfish River resulting from Lagoon effluent?	YES/NO
1.6	Any sheen on Jackfish River?	YES/NO

SHOP TRACK/WTF

1.0 Shop Track Skimmer Unit/Sump Pump/Waste Oil Recovery Tank

1.1	Is system operational?	YES/NO
1.2	Clean wiper blades.	_____
1.3	Meter reading.	_____
1.4	Depth to product in waste oil tank (m).	_____
1.5	Depth to water in waste oil tank (m).	_____

2.0 WTF BUILDING

2.1	Test all components by turning to manual operation.	
2.2	Depth to product in holding tank.	_____
2.3	Depth to water in holding tank.	_____
2.4	Depth to fluid in tanker (m).	_____

COMMENTS

_____

_____

_____

- Clean ORS and return to East End building.
- Sign inspection logs at West End, East End and Shop Track Building.
- Fax inspection form to Nick – KGS Thunder Bay @ (807) 473-5671.
- Office Number (807) 623-2195, Extension 242.

APPENDIX C

WEST END DIESEL RECOVERY SYSTEM INSPECTION FORM

CN HORNEPAYNE YARD
WEST END MONTHLY INSPECTION
13-0434-004

Inspector: _____ Date: _____

Climatic Conditions: _____

Wind Direction: _____

1.0 Skimmer

1.1 Clean wiper blades _____

1.2 Clean trough _____

1.3 Clean sediment basket _____

1.4 Drain Water from Recovery Basket _____

1.5 Check if both wiper blades are in contact with the skimmer belt _____

1.6 What is the condition of the wiper blades? _____

1.7 Check skimmer belt for cracks or abrasions _____

1.8 Check if skimmer belt is centered _____

1.9 Check discharge pipe to Waste Oil Recovery Tank for cracks or leaks [1]

Note:
1.0 If a crack or leak is found shut down the skimmer and contact Tony Gallo at (807) 623-2195.

2.0 5,000 Gallon Waste Oil Recovery Tank

2.1 Check piping and fittings for cracks or leaks [1] ☐

2.2 Depth to LNAPL _____ m

2.3 Depth to Water _____ m

Note:
1.0 If a crack or leak is found shut down the skimmer and contact Tony Gallo at (807) 623-2195.

3.0 Diesel Recovery Lagoon

3.1 Is there any LNAPL in the Lagoon? Yes ☐ No ☐

3.2 Which end of the Lagoon is the free LNAPL located? NW ☐ SE ☐

3.3 Check for any evidence of erosion _____

_____

3.4 Check for any seepage on the SW wall of the Lagoon _____

_____

3.5 Measure distance from top of weir to water level in Lagoon _____ m

3.6 Check DRL discharge culvert for any obstructions ☐

4.0 Underdrains

Underdrain	Flow (Steady/Drip/None)	Sheen or Free Product (Yes/No)	Drain Above or Below Water in Lagoon
1			
2			
3			
4			
5			
6			
7	N/A	N/A	N/A
8			
9			
10			
11			

5.0 Discharge Trench

5.1 Check for any evidence of bank erosion _____

_____

5.2 Check for any evidence of bubbling of the liner _____

_____

5.3 Is there sheen on the trench water? Yes ☐ No ☐

If yes, is the sheen of hydrocarbon or tannic acid origin? _____

6.0 Effluent Discharge to Jackfish River

6.1 Is there any sheen on effluent being discharged from the concrete control structure? Yes ☐ No ☐

6.2 Is there any sheen on the Jackfish River resulting from discharge of the Remedial System? Yes ☐ No ☐

6.3 Check if the discharge end of the discharge pipe is free of obstruction ☐

7.0 Monitoring Well Network

Monitoring Well	Depth To Product (m)	Depth To Water (m)	Thickness of Product (m)
MW-10			
MW-11			
MW-12			
MW-120			
MW-122			
OW8-2			
OW9-3			
Sump			

8.0 General Observations / Comments:

REPLACE KEY AT SKIMMER BUILDING

Signature: _____

APPENDIX D

LAGOON NO. 2 LNAPL CONTAINMENT SYSTEM INSPECTION FORM

CN HORNEPAYNE YARD
EAST END MONTHLY INSPECTION

KGS GROUP

Project Name:	PHASE IV RAP	**Project Number:**	13-0434-004
Client:	CANADIAN NATIONAL	**Location:**	HORNEPAYNE, ONTARIO
Inspector:		**Date:**	
Weather:			

*** OPEN DOORS TO BOTH BUILDINGS TO ALLOW FOR AERATION ***

OIL / WATER SEPARATOR BUILDING

1.0 Oil/Water Separator

1.1	Is there any LNAPL in the clean water discharge?	Yes _____ No _____
1.2	Check for any leaks around OWS	_____
1.3	Adjust collection line and skim LNAPL, as required	_____

2.0 Transfer Tank

2.1	Check level in transfer tank	_____
2.2	Check for any leaks	_____
2.3	Check operation of the floats	_____

3.0 Air Dryer Unit

3.1	Inspect air dryer unit to ensure proper operation	_____

COMPRESSOR BUILDING

1.0 Compressor

1.1	Check all fittings for leaks	_____
1.2	Test to ensure proper operation	_____

OUTSIDE OF BUILDINGS

1.0 Waste Oil Recovery Tank

1.1	Depth to LNAPL	_____m
1.2	Depth to water	_____m
1.3	Check piping and fittings for leaks	_____

2.0 Interception Trench Sump

2.1	Depth to LNAPL	_____m
2.2	Depth to water	_____m

3.0 Lagoon No.2

3.1	Take sample of Lagoon No. 2 effluent to Little Jackfish Creek at culvert	_____
3.2	Is there any sheen on Jackfish Creek resulting from effluent discharge?	YES / NO
3.3	Lagoon No. 2 observations (any LNAPL or sheen?)	

_____

_____

4.0 Monitoring Well Network

Monitoring Well	Depth to Water	Depth to LNAPL	LNAPL Thickness	Volume Bailed
OW5-4				
OW5-2				
MW-21				
PW-2				
PW-3				
PW-4				
PW-5				
PW-6				
PW-7				
PW-8				
PW-9				
PW-10				

5.0 General Comments / Observations

Signature: _____

APPENDIX E

SHOP TRACK DIESEL RECOVERY SYSTEM AND WASTE TRANSFER FACILITY INSPECTION FORM

CANADIAN NATIONAL
WASTE TRANSFER FACILITY AND SHOP TRACK REMEDIAL SYSTEM INSPECTION
HORNEPAYNE YARD, HORNEPAYNE, ONTARIO

Project No. 13-0434-004

Date: _____ Inspector: _____

Time: _____ Weather: _____

In case of Environmental Protection System Emergency, contact Tony Gallo at (807) 623-2195 (8-5pm)

1.0 WASTE TRANSFER FACILITY BUILDING

1.1 Visually inspect the OWS clean water discharge chamber (CWD).

Is there evidence of biogrowth in CWD? Yes/No

Is there evidence of LNAPL in CWD? Yes/No

1.2 Measure depth to product and water in the OWS.

DTP _____m

DTW _____m

Thickness _____m

1.3 Inspect condition of piping leading into and out of the OWS unit for leaks. _____

1.4 Turn transfer pump and sump pump to 'hand' to test. _____

2.0 CN TANKER INSPECTION

2.1 Measure level in tanker.

DTP _____m

DTW _____m

2.2 Record any observations.

3.0 WASTE OIL HOLDING TANK INSPECTION

3.1 Measure level in holding tank.

DTP _____m

DTW _____m

3.2 Record any observations.

4.0 SKIMMER UNIT

4.1	Clean Wiper Blades.		_____
4.2	Clean Trough.		_____
4.3	Check Belt for cracks or abrasions.		_____
4.4	Check for leaks in piping.		_____

5.0 SUMP AND SUMP PUMP

5.1	Measure depth to product and water.	DTP	_____m
		DTW	_____m
5.2	Turn to manual to test.		_____
5.3	Meter Reading.		_____L
5.4	Does pump appear to be operational?		Yes/No

6.0 WASTE OIL RECOVERY TANK

6.1	Measure the depth to LPH and water.	DTP	_____m
		DTW	_____m
6.2	Is a vacuum present?		Yes/No
6.3	Any leaks in Piping?		Yes/No

7.0 OBSERVATION WELLS

7.1	MW 126	DTP	_____m
		DTW	_____m
7.2	OW3-2	DTP	_____m
		DTW	_____m

8.0 NOTES/OBSERVATIONS

Signature: _____

APPENDIX F

ABANAKI OIL GRABBER MODEL 8 OIL SKIMMER MANUAL

CONTENTS

Chapter	Content	Page
1	INSTALLATION	3-5
2	SPARE PARTS	6
3	MAINTENANCE	7
4	DATA	8
	General Specifications	8
	Oil Grabber® Model 8 Overall Dimensions Channel Mount	9
	Oil Grabber® Model 8 Overall Dimensions Flat Mount	10
5	OPERATION	11
	Operating the Model 8	11
	Safety	11
	Warranty	11

OIL GRABBER® Model 8

A dependable and effective means of removing oil from water and water-base solutions. Often, skimming by itself will reduce oil to an acceptable level of water purity. Depending on the characteristics of the liquid, it is possible for the Model 8 alone to reduce oil content to less than five parts per million in water. The unit can be used as a pretreatment before filtration, and in conjunction with a coalescing system. Special options with the Model 8 include: all stainless steel construction, vapor tight enclosure, infrared heater hood for non-explosive freezing applications and a complete system control box. Also, the Model 8 has the versatility of the standard channel mount or optional flat surface mount.

.OOR STAND OPTION: If mounting on floor stand, follow separate instructions enclosed.

ep 2. Remove the screen guard over the head pulley by lifting straight up.

ep 3. Locate the adjustable wiper assembly and loosen the locknut. Turn adjusting screw clockwise until wiper is npletely open. (SEE FIG. 3)

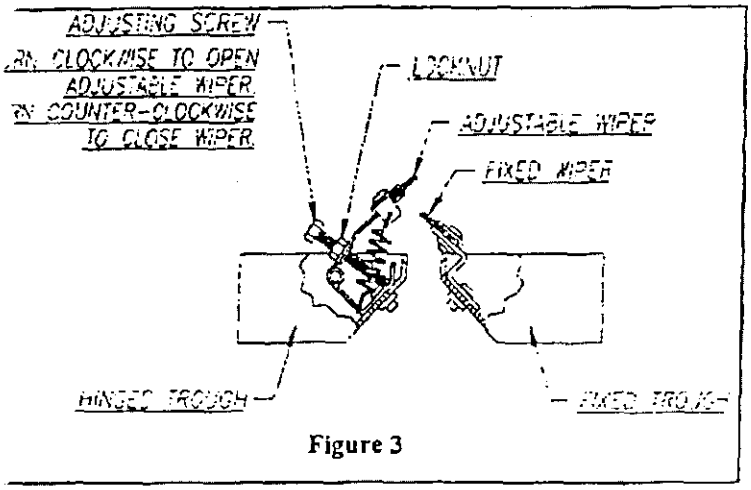


Figure 3

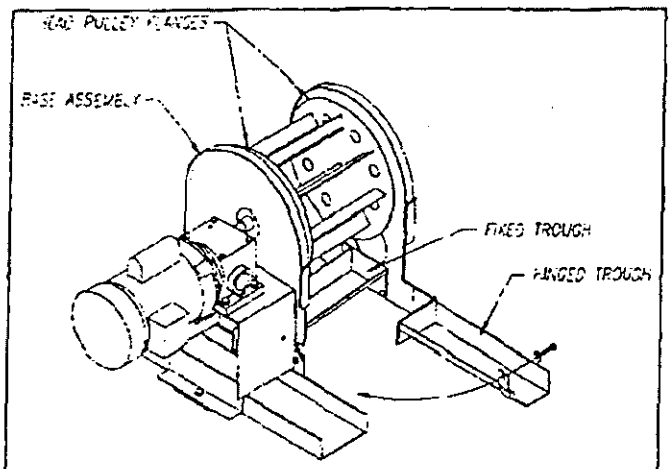


Figure 4

.ep 4. Remove ¼-20 bolt on main base holding hinged trough closed. wing open hinged trough. (SEE FIG. 4)

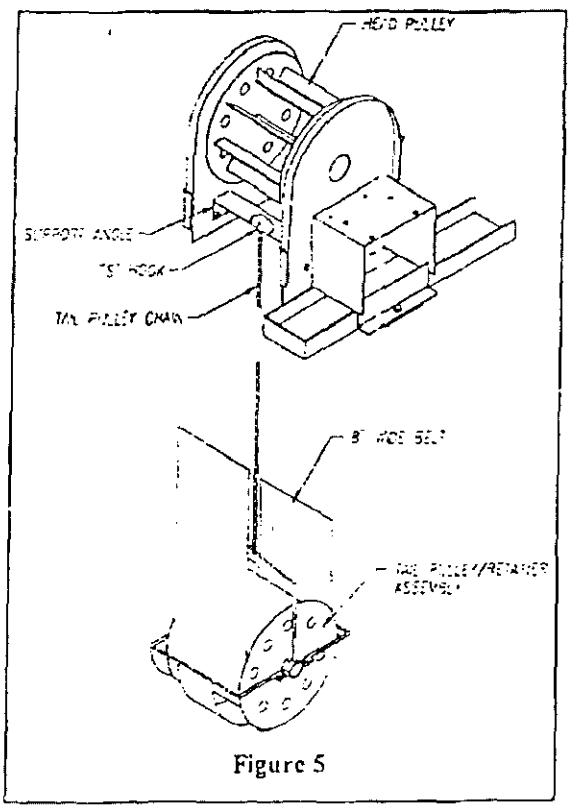


Figure 5

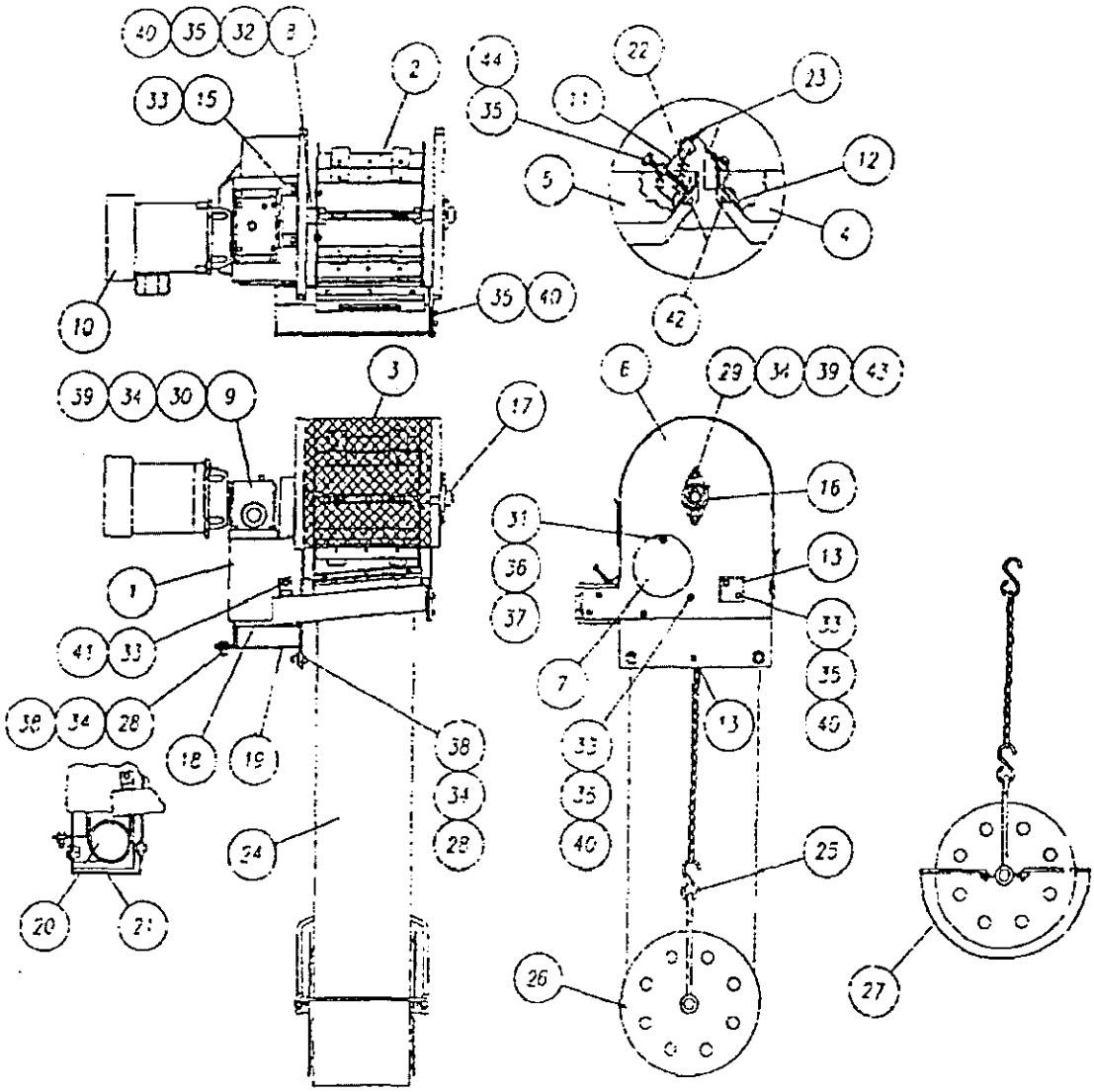
tep 5. Unpack the belts carefully following the directions in the carton.
A. When handling metal belts wear cloth gloves.
B. Dents or creases can cause premature wear.

ep 6. Lift the belt over onto the head pulley between the head pulley anges. (SEE FIG. 4) Carefully swing the trough closed, taking care not to ch the belt in the hinge. Re-bolt the trough end onto the frame.

tep 7. (SEE FIG. 5) If you have purchased the *Yoke and Tether* ion continue with step 8. If you have purchased the *"Tail Pulley-'etainer-Belt Assembly"* option follow those instructions enclosed and ntinue with step 10. If neither of these options apply, continue with step Note: Whichever option you have, the tail pulley must be fully ubmerged below the surface.

ep 8. Place an "S" hook through the hole on the inside support angle, SEE FIG. 5) and hook the last link of the chain onto the bottom loop of "S" hook. Lower the tail pulley into the belt. The tail pulley is supported by the belt, not the chain. Make certain that the elt is taut by the weight of the tail pulley and that the chain is loose by two links. Note: Tail pulley must be fully submerged elow the surface. <u>Continue with step 11.</u>

SPARE PARTS



Item	Qty.	Part Name	Item	Qty.	Part Name
1	1	Main Base Weldment	23	2	Wiper Blade
2	1	Head Pulley	24	1	Belt
3	1	Removable Screen Guard	25	1	Yoke & Tether w/Chain
4	1	Fixed Trough	26	1	Tail Pulley
5	1	Hinged Trough	27	1	Yoke & Tether w/Chain & Retainer
6	1	Side Plate (Bearing)	28	3	3/8-16 x 1" Lg. Hex Hd Bolt
7	1	Cover Plate	29	2	3/8-16 x 1" Lg. Carriage Bolt
8	1	Head Pulley Shaft	30	4	3/8-16 x 1.50" Lg. Hex Hd Bolt
9	1	Gear Reducer	31	1	¼-20 x 1.25" Lg. Hex Hd Bolt
10	1	Motor	32	2	¼-20 x .75" Lg. Hex Hd Bolt
11	1	Hinged Wiper Blade Assembly	33	11	¼-20 x .62" Lg. Hex Hd Bolt
12	1	Fixed Wiper Blade Assembly	34	9	3/8-16 Hex Nut
13	1	Support Angle Spacer 10.50" Lg.	35	13	¼-20 Hex Nut
14	1	Adjusting Cam	36	1	¼-20 Locknut
15	1	Coupling Guard	37	1	Spring 3/8x3/4x.032 (Century #526)
16	1	¾" Flange Bearing	38	5	3/8" Flat Washer
17	1	¾" Shaft Collar	39	6	3/8" Lock Washer
18	1	Channel Mount Clamp	40	12	¼" Lock Washer
19	1	Support Gusset	41	1	¼" Flat Washer
20	1	Flat Mount Trough	42	4	¼-20 x .50" Lg. Soc. Hd Cap Screw
21	1	Flat Mount Plate	43	2	3/8" Fender Washer
22	1	Wiper Spring	44	1	¼-20 x 2" Lg. Full Thd Bolt

'RT 1: GENERAL

'1 Construction

Solid welded carbon steel with a baked on powder coat finish.

Color: Dark Safety Blue.

. Optional: 316 Stainless Steel

'2 Pulley Types

. Drive Pulley (Head Pulley)

A. Magnetic drive pulley for metal belt. Two magnet assemblies per cross bar with 8 cross bars per head.

Tail Pulley

A. Solid drum type, free floating in belt.

B. Collars for shaft when used with yoke, chain & retainer.

'3 Motor: (one of two motors standard)

1/4 H.P. 1 PH 60 Hz. TEFC, 1725 RPM, 56 C-Face, 115/208-230 Volt, 5/2.6/2.5 Amps.

1/4 H.P. 3 PH 60 Hz. TEFC, 1725 RPM, 56 C-Face, 208-230/460 Volt, 1.4/1.3/.65 Amps. *

'4 Gear Reducer

Standard C-Face

A. 150:1 double reduction

B. Oil Filled

C. Bronze gears/ball bearings

'5 Guard

Standard flat steel mesh screen over drive pulley area.

...6 Belt Material and Length

. Carbon Steel - Length as required up to 100' center to center.

A. Optional materials: Corrosion Resistant Steel or Elastomer.

1.07 Wiper Blades

1. Standard Material: Nitrile or optional Viton.
   A. Front Wiper Assembly - Spring tensioned with single wiper insert.
   B. Rear Wiper Assembly - Stationary wiper holder, with single wiper insert.

1.08 Oil Discharge Outlet

1. Standard Channel Mount
   A. Dual troughs discharging into a single 5" channel to oil collection tank.
2. Flat Surface Mount (Optional)
   A. Dual troughs discharging through a 3" M.P.T.

1.09 Mounting Arrangements

1. Standard Skimmer Configuration.
   A. 5 x 6.7 (5" channel) x 20" long minimum; also doubles as discharge outlet.
2. Optional Skimmer Configurations
   A. Flat Surface Mount with 3" M.P.T. for piped discharge.
   B. 4 x 7.25 (4" channel) same as 1.09.1, use of 5 x 6.7 preferred.

1.10 Weight and Size

1. 61 lb. skimmer + 20 lb. Motor = 81 lbs/unit
2. Overall size of std. unit: 28"L x 16-1/2"W x 20"H
3. Overall size of unit w/heater: 28"L x 22"W x 20"H
4. Tail Pulley: 10 lbs. Each.

1.11 Mounting Requirements

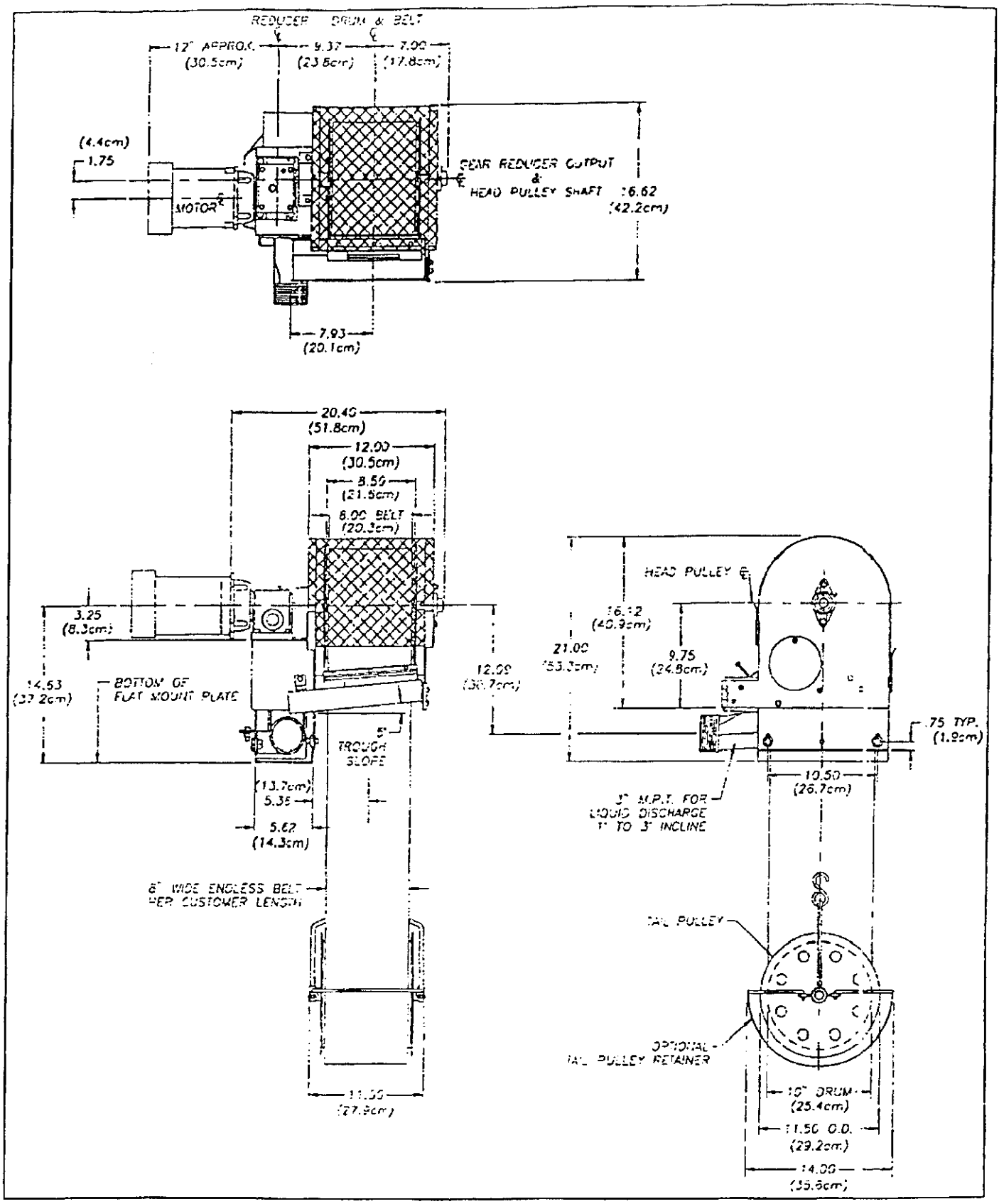
1. Sump opening size for tail pulley: 12" x 14"
2. Minimum Mounting Height: 20"
3. Minimum Mounting Height w/optional 4' stand:
   A. Channel mount: 66-3/8"
   B. Flat mount: 69-1/8"

1.12 Power Requirements

1. Hard wired per motor and local/national code.

1.13 Optional Mounting Arrangements

1. 1x8 Mounting Stand will support a single 1x8 and a single OC-100 decanter. Stand is 48" high.



OIL GRABBER® Model 8 Overall Dimensions

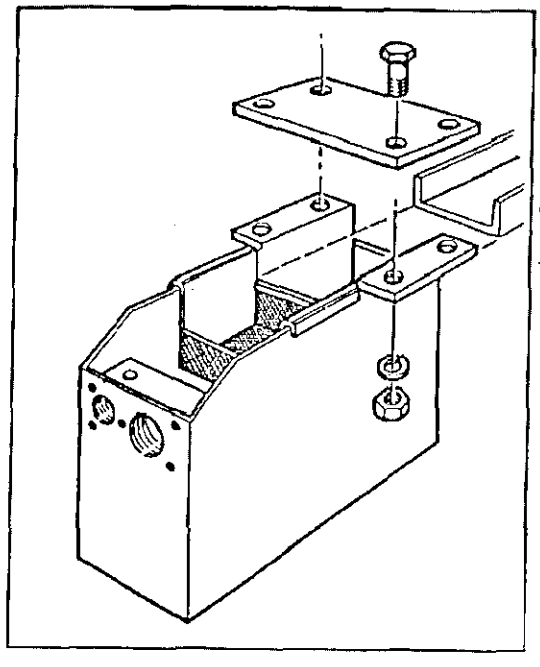
Flat Mount

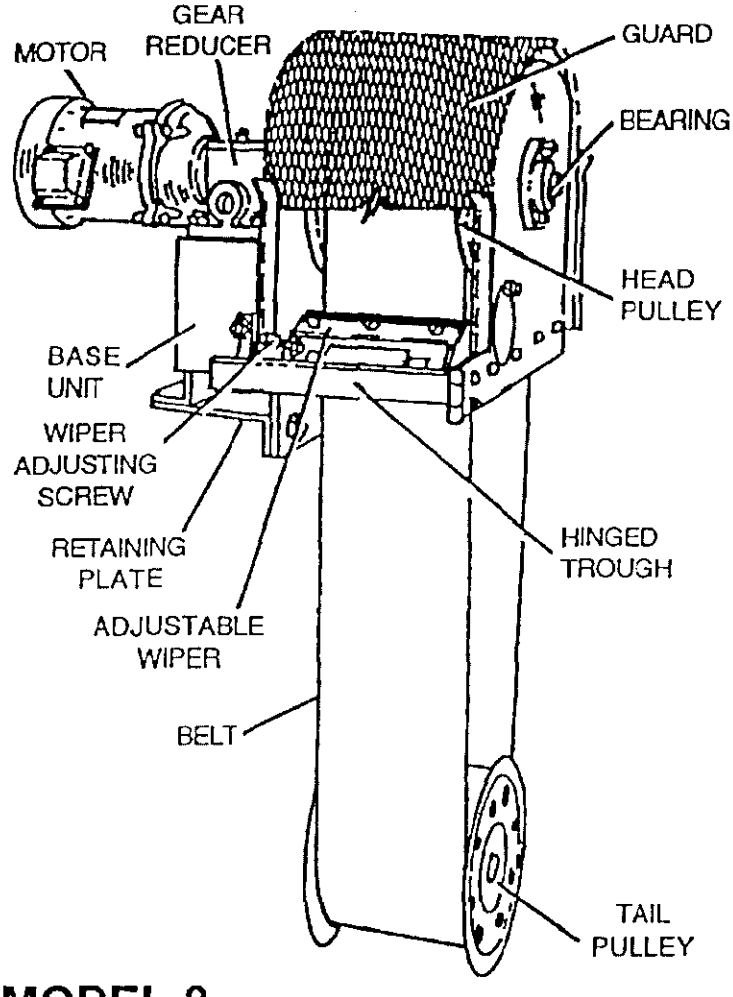
ABANAKI

OIL GRABBER® SKIMMERS
MODEL 8

INSTALLATION INSTRUCTIONS

THE ABANAKI OC 100 OIL CONCENTRATOR®

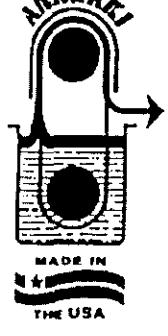




MODEL 8

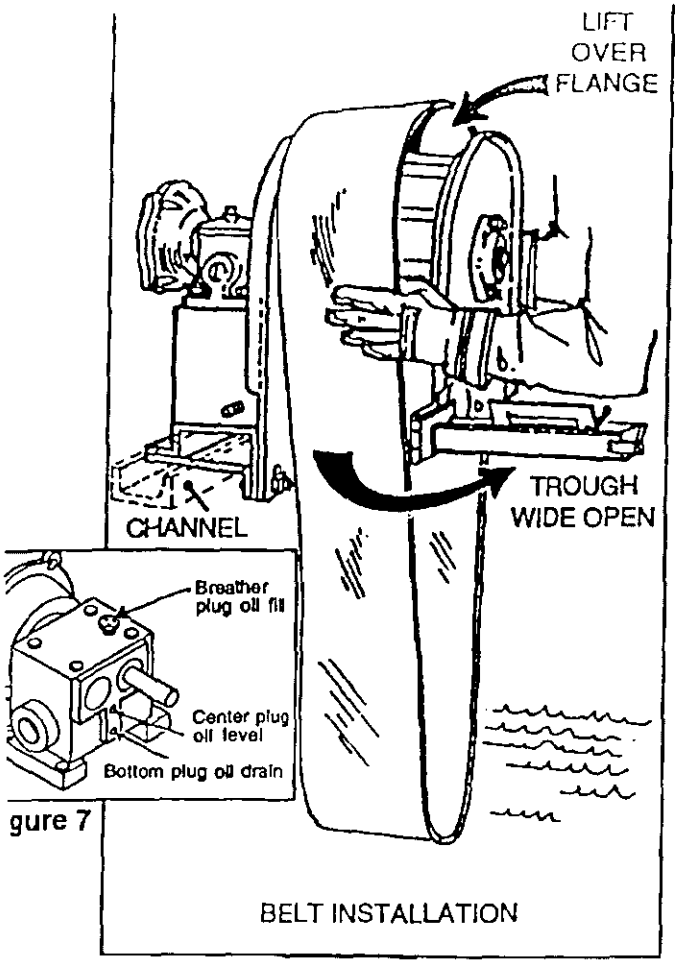
Your Abanaki Oil Grabber® Skimmer has been manufactured and packaged to rigorous standards of design and service. Proper installation of the unit is essential for efficient oil removal and long lasting use.

We have tried to make these instructions as clear as possible. If you have any questions, please call: (216) 543-7400



ABANAKI
CORPORATION
OIL SKIMMER DIVISION

17387 Munn Road
Chagrin Falls, OH 44023
Telephone: 216-543-7400
Fax: 216-543-7404



gure 7

Figure 6

ep 7. Remove the plastic protective plug from the gearbox top and replace with breather plug supplied.

Refer to (fig. 7) Mount motor with shaft key installed and rotate shaft to mate with gearbox. Bolt motor to gearbox with the four bolts and lockwashers provided.

Connect motor leads to power so that the belt is carried downward through the wiper blades (rotation is in direction of the red arrow on the back of the base unit).

ep 8. **If you have purchased the Yoke and Tether option:** place an 'S' hook through the hole in the inside support assembly, (see fig. 10, item 19) and hook the last link onto the bottom loop of the 'S' hook. Lower the tail pulley into the belt. Pull the chain until it is taut, then loosen by two links and re-hook the chain to the skimmer base (fig. 10, items 22 & 23).

If you have purchased the Tail Pulley and Belt and Belt Retainer option: follow the instructions enclosed.

erwise: Gently pull up the belt until the bottom is slightly above the surface. Place the tail pulley in the belt and slowly lower the belt, (taking care not to dislodge the tail pulley), until the belt is once again taut and the pulley is fully submerged below the surface.

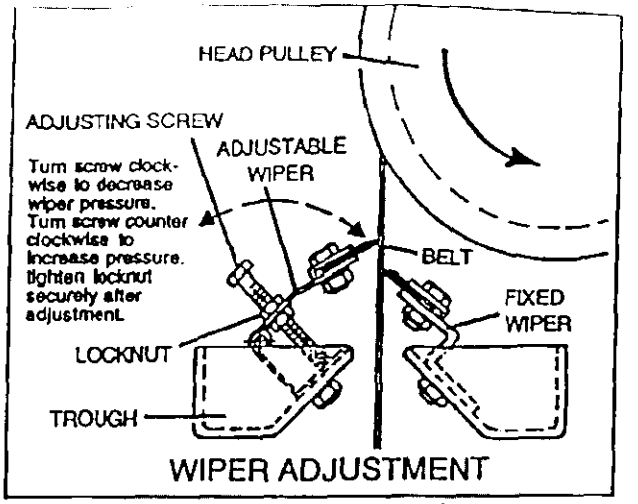


Figure 8

Step 9. Carefully turn adjustment screw on wiper blades so that blades are gently touching belt with even contact for the full length of the blades. (fig. 8) Do not set blades too tight: this could reduce the life expectancy of the belt.

Step 10. LEVELING THE BELT.

Be sure the unit is as level as possible; unit should not be tilted side to side, nor front to rear. Turn motor on and observe the unit. The belt should run without rubbing on the flanges of the head pulley. If the belt is rubbing, unit can be adjusted by turning the leveling cam located on the inside bottom of the inboard plate (fig. 9). The cam must be turned slowly, and observed after each 1/16th of a turn.

After belt is running smoothly tighten down the three mounting bolts on the clamp plate (fig. 1) Channel Mount or Universal Mounting Plate (Flat Mount).

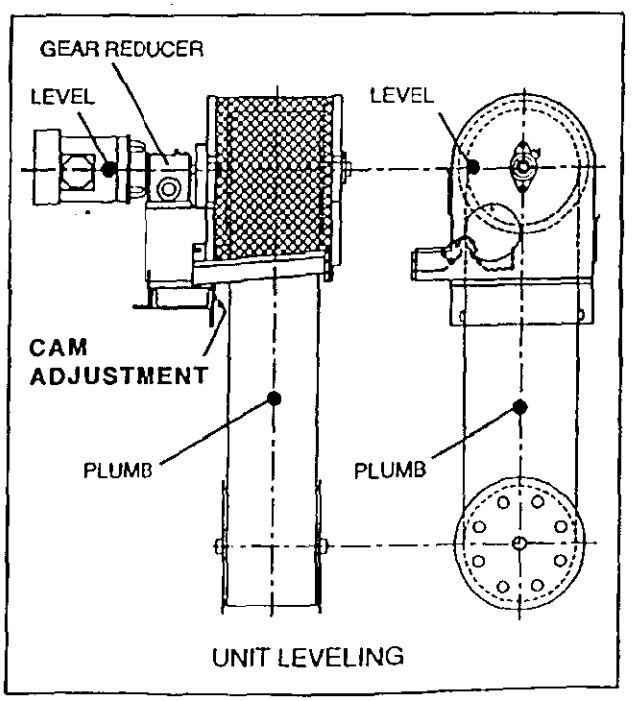


Figure 9

ABANAKI CORPORATION
17387 Munn Road
Chagrin Falls, Ohio 44023
Telephone: 216-543-7400
Fax: 216-543-7404

OC-100 Oil Concentrator®

INSTALLATION INSTRUCTIONS

The Abanaki OC-100 Oil Concentrators offer complete oil/water separation for reuse or disposal of either liquid. Mounted at the discharge end of the oil skimmer support channel, the Oil Concentrator receives the skimmed liquid directly from the skimmer. Based on the principle of gravity separation, water is decanted from the bottom, the lighter weight oil removed from the top.

INSTALLATION INSTRUCTIONS FOR MODEL 8 AND MODEL 4 OIL SKIMMERS

STEP 1. Mount the OC-100 at the discharge end of the channel on which the oil skimmer is mounted. NOTE: Channel should be level or sloping slightly downward from the skimmer.

(A) Loosen the four nuts and bolts in the mounting plate.

(B) Fit the rear of the OC-100 to the bottom of the channel, allowing the channel to extend over the sludge basket. See Fig. 1.

(C) If the channel is sloped, level the OC-100 by tightening the 2 pressure bolts against the bottom bottom of the channel. See Fig. 2 **THE UNIT WILL NOT OPERATE UNLESS IT IS LEVEL.** Tighten the mounting plate bolts. See Fig. 3.

STEP 2. Connect a suitable 3/4" hose to the water outlet, running the discharge end back into the skim tank. Connect a 1-1/4" hose to the oil outlet, running the discharge end to the oil storage tank. (a hose kit is available from Abanaki, part # POC100HOSEAI See Fig. 6.

STEP 3. *Important:* Prime the OC-100 by filling to the outlet ports with water for coolant. **THE UNIT WILL NOT OPERATE UNLESS IT IS PRIMED.** *Note: the OC-100 will maintain a thick oil layer before starting to discharge oil.*

Adjustments:

The OC-100 is preset at the factory and does not need adjustment. Adjustments are tricky and should be made only when skimming a heavy oil.

To properly adjust the OC-100, test it by pouring oil and/or water through the sludge basket at a slow stream, approximating the skimmer input. If a layer of oil develops over 1" thick then insert a flat head screw driver in the hole on the plastic manifold. See (Fig. 4) Turn the pipe counter clockwise to increase the water level (and decrease the oil film level). If water starts coming out the oil outlet, turn the pipe clockwise to bring the water level back down.

Periodic Maintenance Notes:

- Empty sludge basket to prevent clogging.
- If the incoming oil contains fine particles, empty and clean the OC-100 when a layer of sludge has built up on the bottom of the unit. Drain unit through bottom outlet for thorough cleaning.

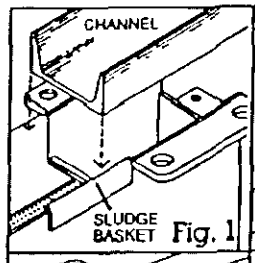


Fig. 1

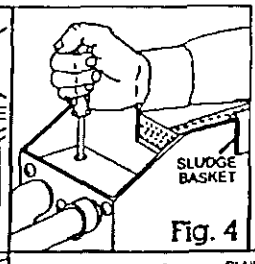


Fig. 4

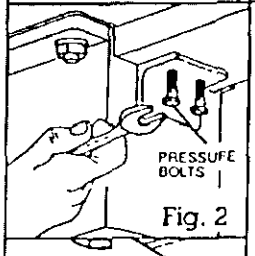


Fig. 2

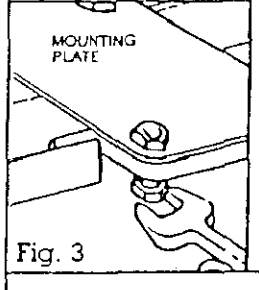


Fig. 3

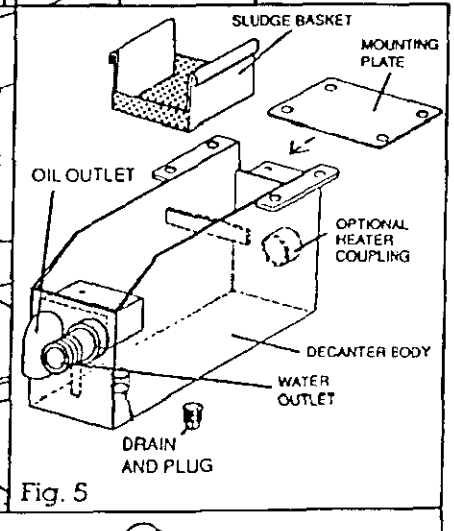


Fig. 5

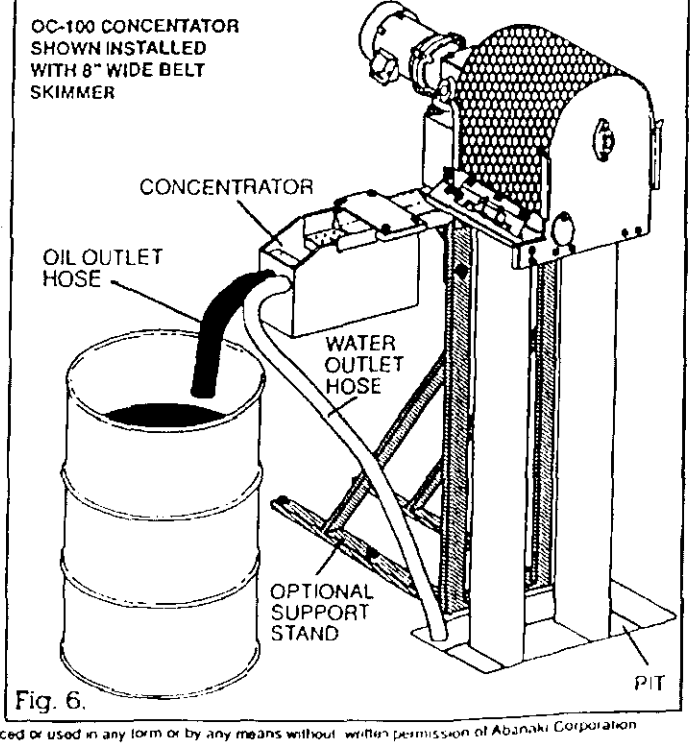


Fig. 6.

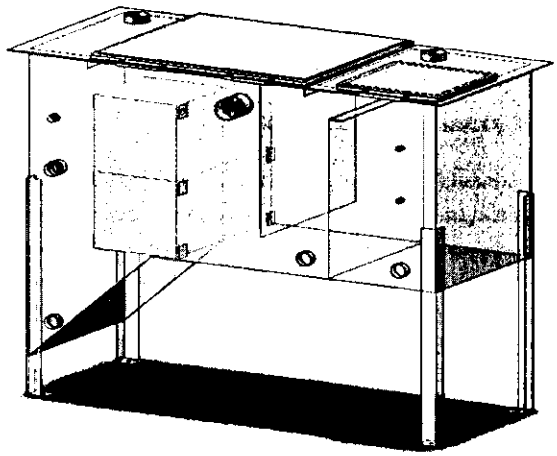
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APPENDIX G

LAGOON NO. 2 OWS SPECIFICATIONS

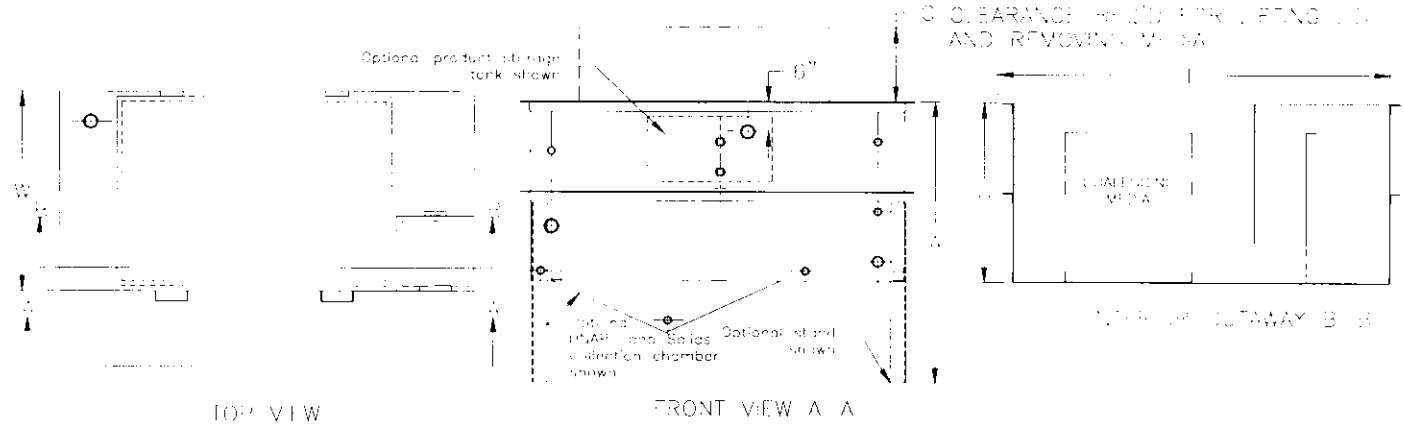
MAPLE LEAF ENVIRONMENTAL EQUIPMENT

OWS-SERIES OIL/WATER SEPARATORS



Application: As the oil/water mixture is passed through the coalescing oil/water separator, larger oil droplets migrate to the surface to be collected and skimmed off. The media collects the smaller droplets until they are large and buoyant enough to float to the surface.

Construction: The standard OWS-Series oil/water separator is fabricated from carbon steel. For corrosion resistance, the interior is epoxy coated and the exterior is painted. Optional stainless steel and marine-grade aluminum construction are also available. A large lid allows access to the coalescing media and oil skimmer while a small lid allows access to the pump-out tank.



Dimensions:

Part Number	Width (in) "W"	Standard Height (in) "H"	Standard Overall Length (in)	Length with Extended Pump out (in)	Height with Elevated Pump out (in) "A"	Required Overhead Clearance (in) "C"	Standard Pump-out Volume (US Gal)	Extended Pump-out Volume (US Gal)	Elevated Pump-out Volume (US Gal)	Product Tank Volume (US Gal)
OWS-2	16	30	64	76	n/a	14	23	41	n/a	8.1
OWS-4	28	30	64	76	n/a	26	46	81	n/a	8.1
OWS-8	28	30	76	88	n/a	26	46	81	n/a	8.1
OWS-12	40	30	76	88	n/a	38	70	122	n/a	8.1
OWS-18	40	30	88	n/a	60	24	70	n/a	130	12.2
OWS-24	52	30	88	n/a	60	24	93	n/a	173	12.2
OWS-36	52	42	88	n/a	72	24	133	n/a	212	17.8
OWS-45	64	42	88	n/a	72	24	166	n/a	265	17.8
OWS-75	100	42	88	n/a	72	24	266	n/a	425	17.8

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Brockville, Ontario K6V 5Y6
800-420-4056

MAPLE LEAF ENVIRONMENTAL EQUIPMENT

OWS-SERIES OIL/WATER SEPARATORS

Rated US GPM (Based on 25 micron particles at 65 deg F and design safety factor of 1.25):

Part Number	HQ PAC		½" Packing		¾" Packing		1 ¼" Packing		Slant Plate	
	Oil (0.9)	Gas (0.72)	Oil (0.9)	Gas (0.72)	Oil (0.9)	Gas (0.72)	Oil (0.9)	Gas (0.72)	Oil (0.9)	Gas (0.72)
OWS-2	9.7	27.0	5.0	14.1	3.5	9.8	2.3	6.3	0.9	2.5
OWS-4	19.3	54.0	10.1	28.2	7.0	19.7	4.5	12.7	1.8	4.9
OWS-8	38.6	108.1	20.2	56.5	14.0	39.3	9.1	25.4	3.5	9.8
OWS-12	57.9	162.1	30.3	84.7	21.1	59.0	13.6	38.1	5.3	14.7
OWS-18	86.9	243.2	45.4	127.1	31.6	88.4	20.4	57.1	7.9	22.1
OWS-24	115.8	324.2	60.5	169.5	42.1	117.9	27.2	76.1	10.5	29.5
OWS-36	159.2	445.8	68.1	190.7	47.4	132.6	30.6	85.7	11.8	33.2
OWS-45	199.0	557.3	85.1	238.4	59.2	165.8	38.2	107.1	14.8	41.5
OWS-72	318.5	891.7	136.2	381.4	94.7	265.3	61.2	171.3	23.7	66.3

NOTES: Larger spaced packing will not plug as quickly as closely spaced packing allowing longer intervals between maintenance requirements. The slant plate coalescer should be used in applications with heavy sludge loads because it does not foul quickly.

Standard Features:

- Interior is epoxy coated. Exterior is painted MLE Blue over zinc primer (except stainless steel and marine-grade aluminum option).
- Sacrificial anode to prevent corrosion of tank.
- 11 AWG carbon-steel construction.
- Sludge containment section.
- Adjustable oil skimmer.
- Water underflow/overflow weir design.
- Easy removal of coalescing media for cleaning.
- High Alarm Level coupling and Pump High/Low Level coupling in the pump out chamber.

Options:

- DNAPL Separation
- Stainless steel construction
- Marine-grade aluminum construction
- Stand
- Oversized pump out
- Product storage tank
- Custom size
- Custom media

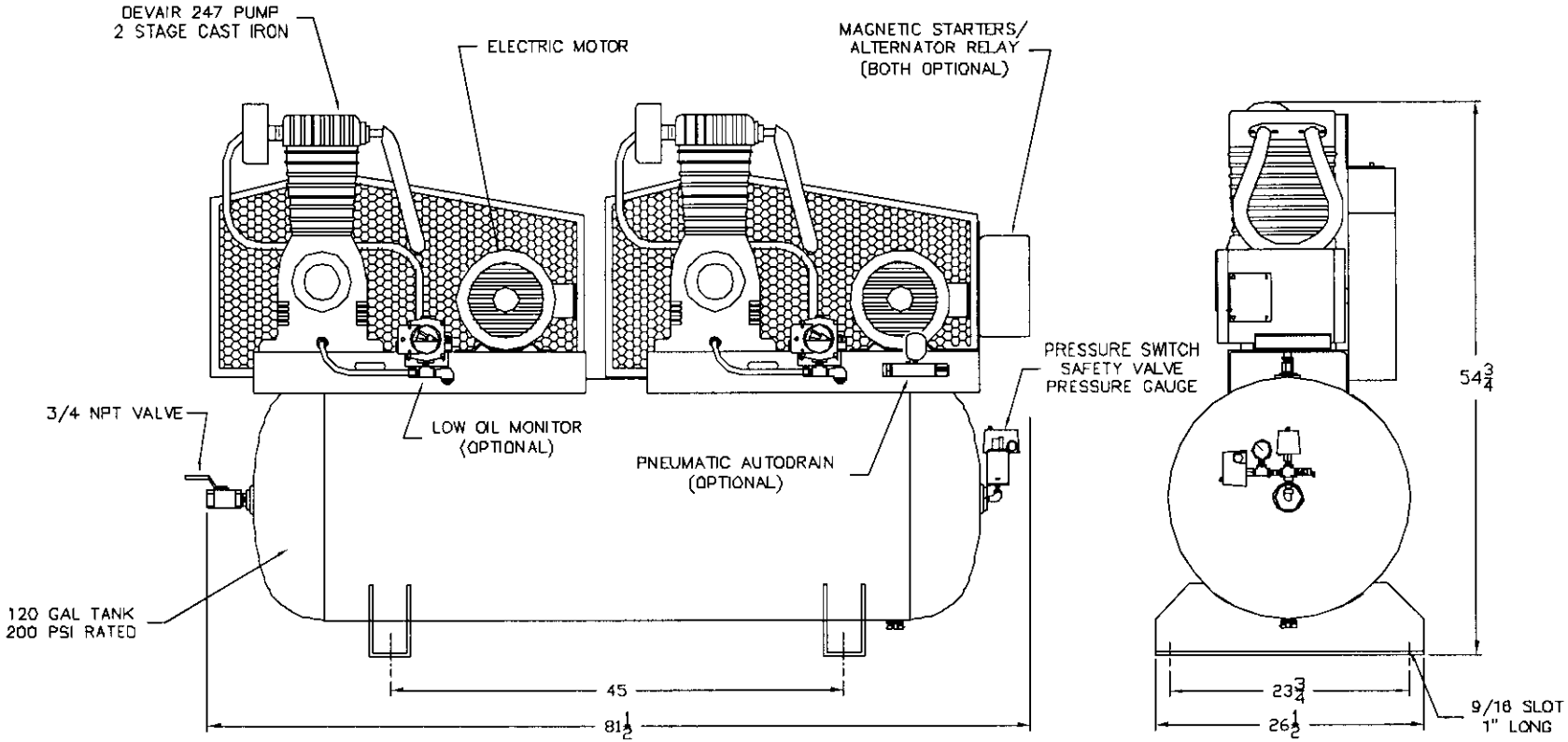
Your Local Representative:

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Brockville, Ontario K6V 5Y6
800-420-4056

APPENDIX H

AIR COMPRESSOR MANUAL

REV.	DATE	REVISION DESCRIPTION	PCN NO.



NOTE: THE COMPRESSOR SHOWN IS AN 'XL' MODEL. THIS PACKAGE INCLUDING THE (2) MOUNTED MAGNETIC STARTERS, ALTERNATOR RELAY, (2) OIL MONITORS, AND (1) PNEUMATIC AUTODRAIN.

COMPRESSOR OUTFIT DATA				PRESSURE SETTING		RECEIVER CAPACITY		COMPRESSOR PUMP DATA				WEIGHT		ELECTRICAL					
MODEL	HP	DISPL. SCFM	DEL'Y SCFM	PSIG	KPA	GAL.	LITRS	TYPE	CYLD.	STAGE	RPM	LB.	KG.	VOLTAGE	230/1	200/3	230/3	460/3	575/3
TAP-5562	5	2 X 23.4	2 X 19.8	150	1034	120	454	247	2	2	635	1073	487	F.L.A.	23.0	15.2	13.2	6.6	5.3

IMPORTANT NOTE: This print is the confidential property of DEVAIR, INC. It is not to be used or reproduced in any manner, nor submitted to other parties for examination without the prior approval of DEVAIR, INC.

FRACTIONAL DIMENSIONS: ±1/32
DECIMAL DIMENSION: ±.005
ANGLES: ±1°
*UNLESS OTHERWISE SPECIFIED

DEVAIR

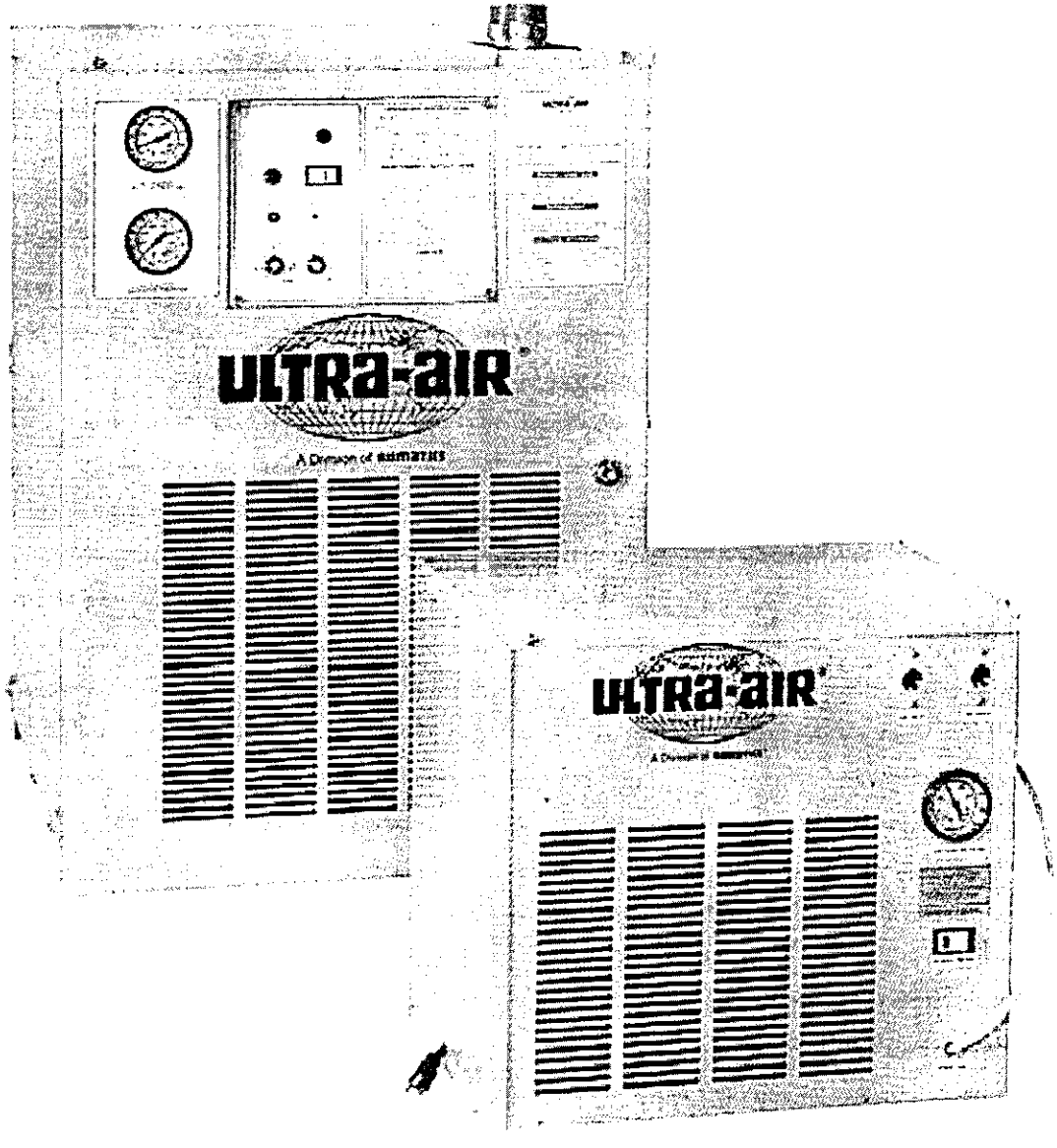
NAME OF PROJECT				DESCRIPTION OF DRAWING
5 HP DUPLEX C/W 247 PUMPS				COMPRESSOR OUTFIT
DRAWN BY	CHECKED BY	DATE	SCALE	DRAWING NO. / SAT NO / REV.
A SMITH		20NOV'00	N.T.S.	TAP-5562

000194

APPENDIX I

REFRIGERATED AIR DRYER MANUAL

numatics®



UA Series
Refrigerated Air Dryer

Operator's Manual

Introduction

This manual contains information and recommendations for installing, operating, and servicing the Numatics Refrigerated Dryer. Numatics Refrigerated Dryers are the highest quality dryers available. We back this claim with one of the longest warranties available in the industry. All units are totally self-contained and have been fully tested and inspected by Numatics before shipment from the factory.

The information, specifications, and illustrations in this manual are in accordance with the information in effect at the time of printing. Numatics reserves the right to change design and specifications without notice and without incurring obligation.

Please read this manual carefully before locating and installing your dryer. Any questions or problems not covered herein may be directed to your Numatics or Ultra-Air distributor or to Numatics Air Preparation Group, 3309 John Conley Drive, Lapeer, MI 48446, or by phone at (810)667-3900 or fax at (810)667-3902. Before calling, be sure to have the model and serial numbers available. The manufacturer will not be responsible for parts returned without proper authorization.

Warnings

Only persons experienced and licensed to work on electrical, refrigeration, and compressed air systems should install or operate this equipment.

This entire manual should be read and understood before starting installation or operation of this dryer. Before starting, installing, or performing maintenance procedures, the main power must be turned off and the dryer must be depressurized to 0 PSIG.

Do not remove, repair, or replace any item on this dryer while it is under pressure and/or the power is turned on. This dryer contains refrigerant R134A or R22. Service personnel must be certified to handle R134A and R22 and comply to all local, state, and federal regulations concerning refrigerant when performing maintenance or service on this dryer. Never operate this dryer above the maximum rated operating conditions. Operating above specified conditions will result in inferior performance and could damage the unit and/or cause personal injury.

Numatics, Inc. will not be held responsible for removal, reinstallation, down time costs, or consequential damages caused by the refrigerated air dryer even if the possibility of such incidental or consequential damages has been made known to Numatics, Inc.

Receiving and Inspection

Upon arrival, remove all packaging materials and inspect dryer carefully. Inspect cabinets for dents, inlet and outlet connections for damage, and skid for any oil due to refrigerant leaks. Inspect refrigerant gauges; they should read at least 40 PSIG and not be damaged. If they do not read at least 40 PSIG, do not start the dryer, instead, contact the factory immediately. If any damage is found, report it to the freight company immediately.

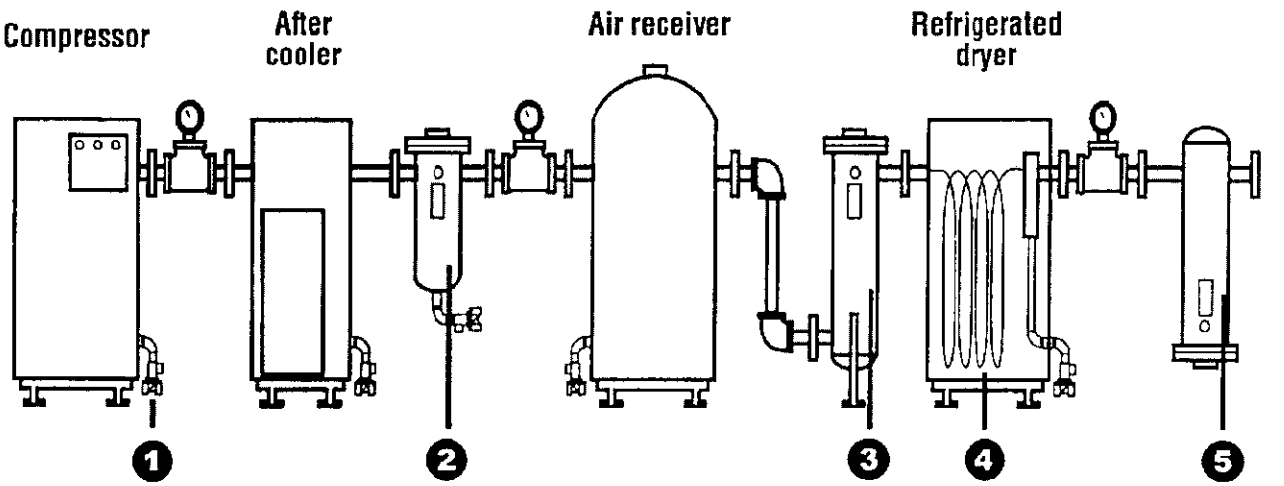
Installation

Allow three (3) feet on all sides of the dryer for service and proper air flow. The dryer should be installed in ambients where temperatures do not drop below 40°F or rise above 110°F. Dryers are normally installed downstream of the receiver tank to prevent undue surging. Unit should be sitting level. Always select an installation site where ample with ventilation, particularly for air-cooled condenser units. An adequate supply of outside air may be made available by using an exhaust system to avoid recirculation of room air. An area with a high ambient temperature will affect the efficiency of an air-cooled (continued)

Installation (continued)

condenser with a resulting increase in workload on the refrigeration compressor. This can conceivably reduce the life of the equipment and hinder its operation. Dryers operating in ambients lower than 40°F ambient must be ordered with a low ambient control option.

Recommended Installation



1) Drain valve: automatically expels water on timed sequence, eliminating the potential of water buildup.
2) Water separator: uses centrifugal action to spin large volumes of liquid out of the system. Use with drain valve is highly recommended.
3) Heavy duty coalescer (1.0 micron): removes bulk amounts of oil aerosols through impingement separation. Should have drain valve to prevent moisture collection. Protects refrigerated dryer from oil coating on interior walls, as oil acts as an insulator and reduces the efficiency of the dryer.
4)UA Series refrigerated air dryer: Lowers compressed air dewpoint.
5) Heavy duty coalescer (1.0 micron)

Drain Connections

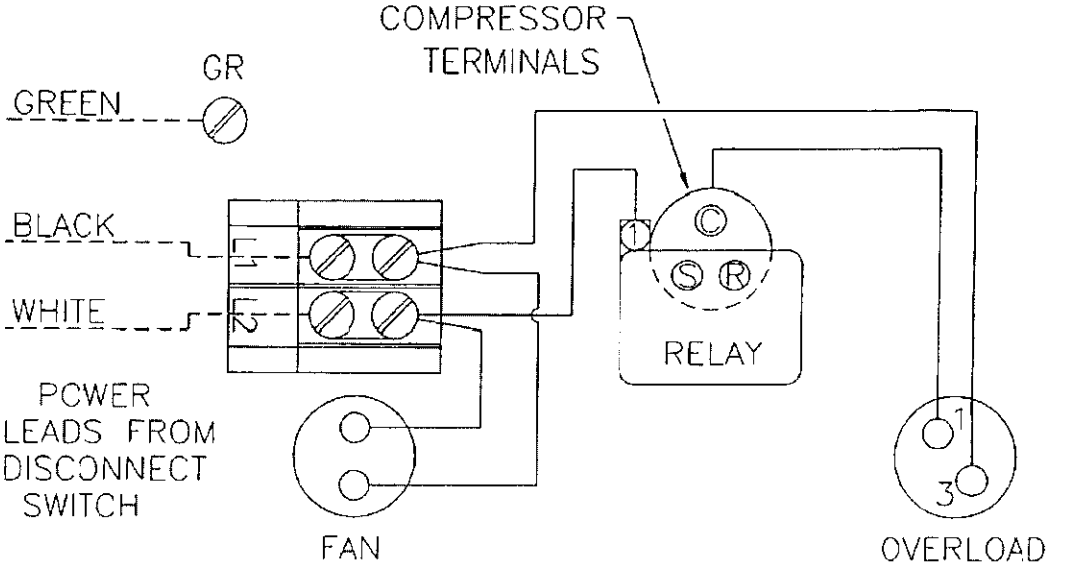
Models UA10 through UA75 come standard with automatic float drains. Models UA100 through UA2000 are equipped with a solid state timer actuated solenoid valve drain system. The drain line from the dryer should be sloped and emptied into a floor drain or connector that is lower than the bottom of the separator in the dryer so the condensate that is removed by the dryer can be drained by gravity.

Electrical Requirements

The nameplate on the instrument panel on each unit identifies the power supply requirements. A suitable wall-mounted disconnect switch in accordance with national and local code requirements is recommended.

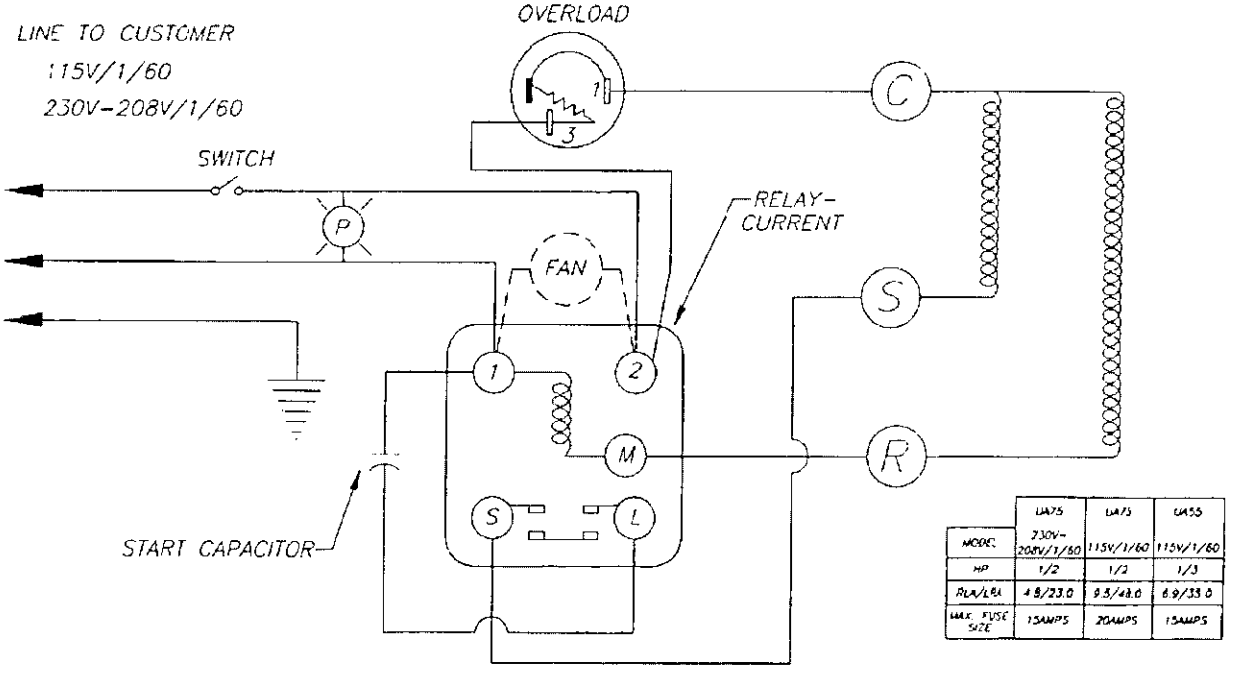
Electrical Schematic

Models UA10AC through UA45AC, 115V-1PH-60Hz



NOTES
1. VOLTAGE: 115-60-1. RANGE: 103.5-126.5

Models UA55AC through UA75AC, 115V through 230V-1PH-60Hz

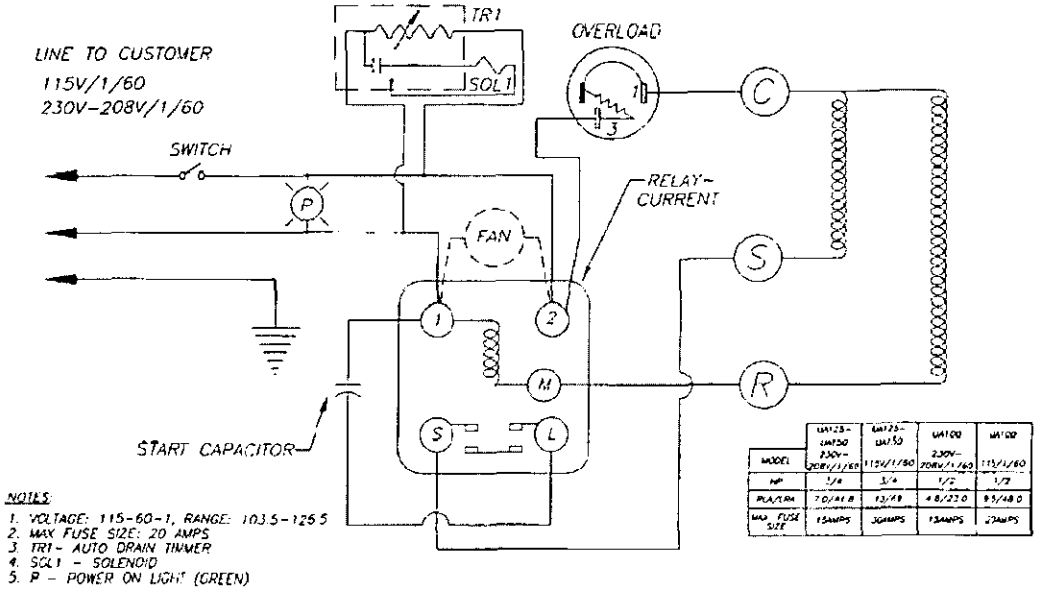


	UA75	UA75	UA55
MODEL	230V-208V/1/60	115V/1/60	115V/1/60
HP	1/2	1/2	1/3
RLA/LRA	4.8/23.0	9.5/48.0	6.9/33.0
MAX. FUSE SIZE	15AMPS	20AMPS	15AMPS

NOTES:
1. VOLTAGE: 115-60-1. RANGE: 103.5-126.5

Electrical Schematic (continued)

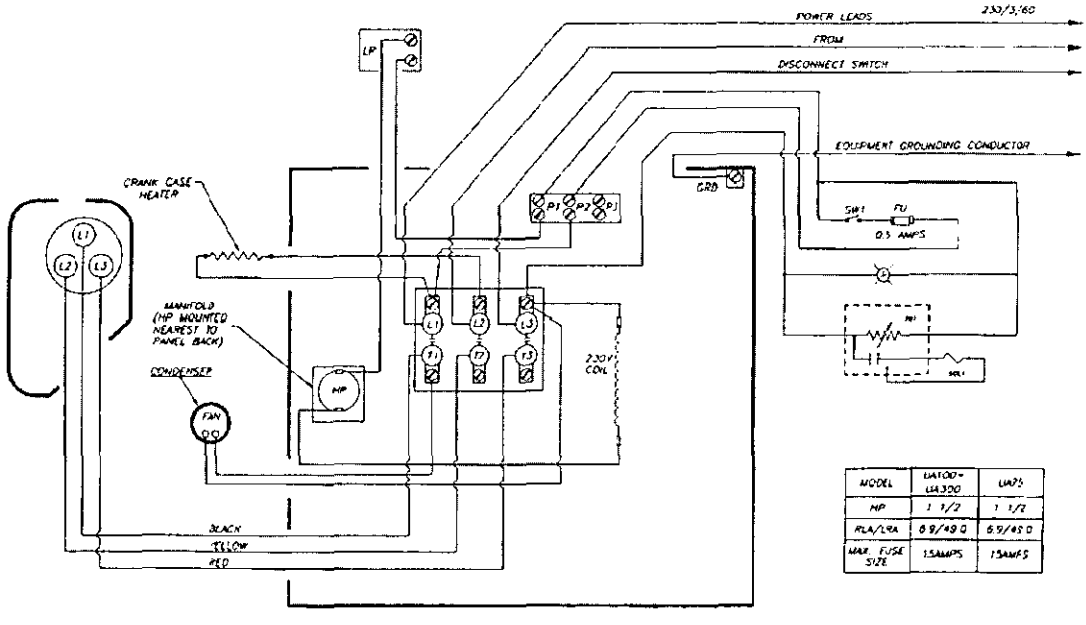
Models UA100AC through UA150AC, 115V through 230V-1PH-60Hz



MODEL	UA125-UA150 230V-208V/1/60	UA125-UA150 115V/1/60	UA100 230V-208V/1/60	UA100 115V/1/60
HP	1/4	3/4	1/2	1/2
RLA/LRA	7.0/41.8	13/49	4.8/22.0	9.5/48.0
MAX. FUSE SIZE	15AMPS	30AMPS	15AMPS	25AMPS

NOTES:
1. VOLTAGE: 115-60-1, RANGE: 103.5-126.5
2. MAX FUSE SIZE: 20 AMPS
3. TR1- AUTO DRAIN TIMMER
4. SOL1 - SOLENOID
5. P - POWER ON LIGHT (GREEN)

Models UA75AC through UA300AC, 230V-3PH-60Hz



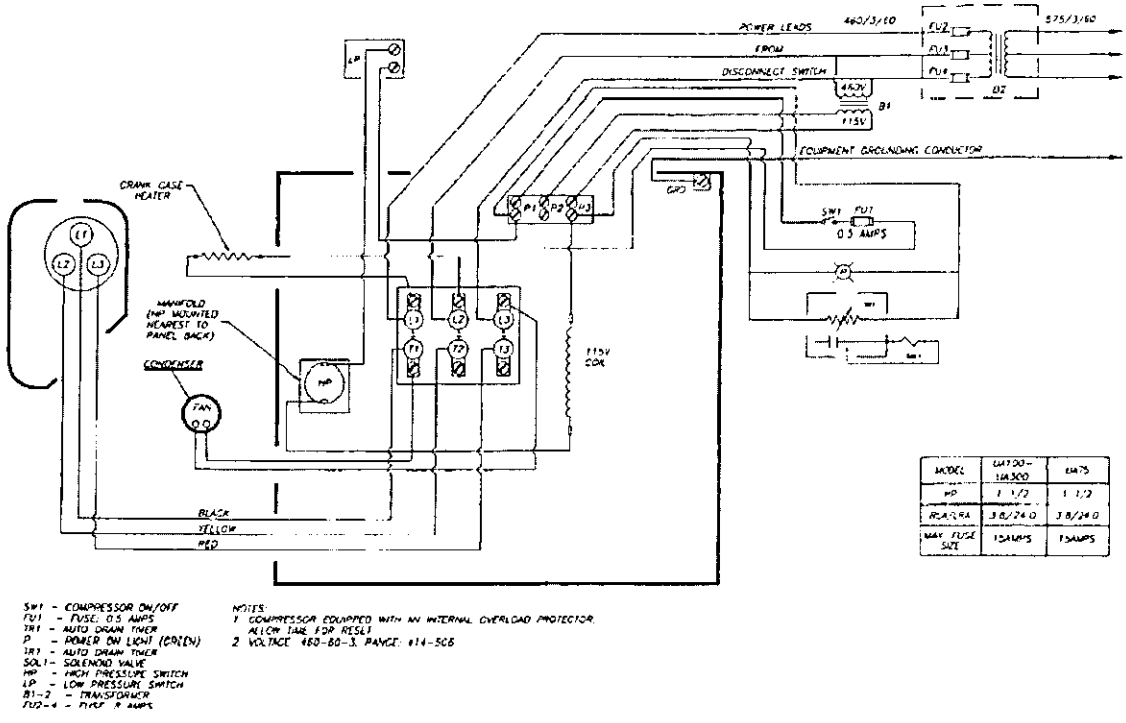
MODEL	UA100-UA300	UA75
HP	1 1/2	1 1/2
RLA/LRA	8.9/49.0	8.9/49.0
MAX. FUSE SIZE	15AMPS	15AMPS

SW1 - COMPRESSOR ON/OFF
FU - FUSE
TR1 - AUTO DRAIN TIMER
P - POWER ON LIGHT (GREEN)
HP - HIGH PRESSURE SWITCH
LP - LOW PRESSURE SWITCH
SOL1- SOLENOID VALVE

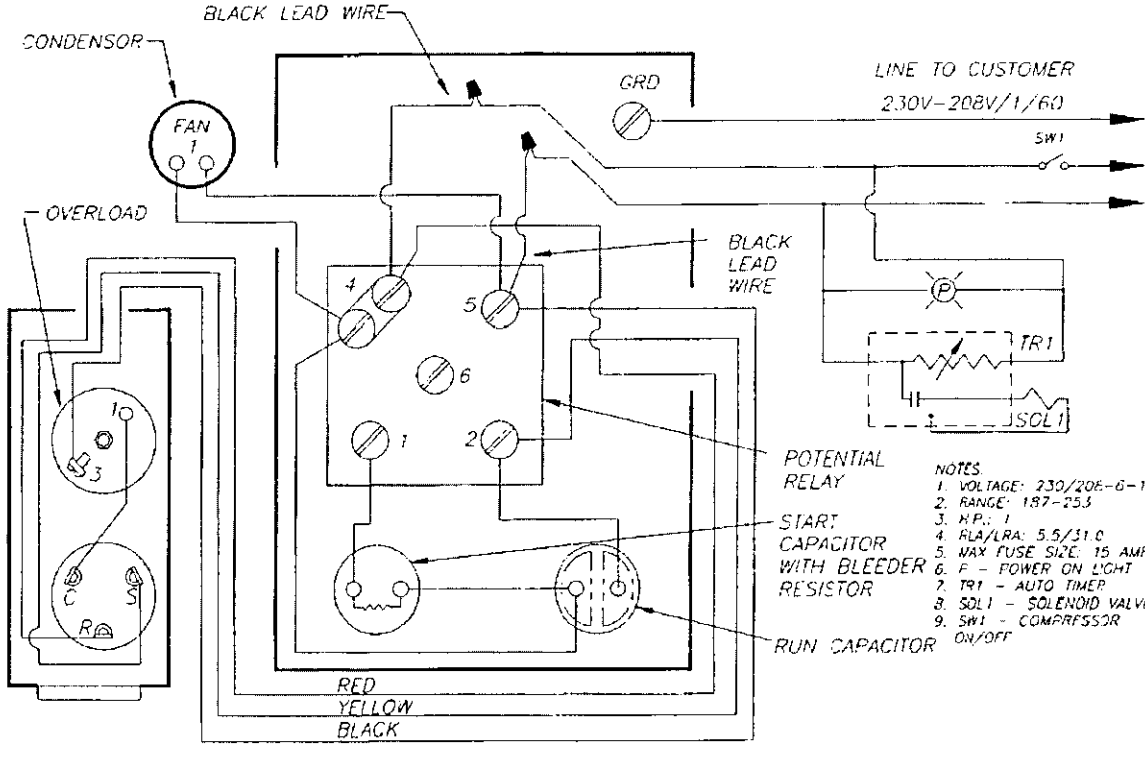
NOTES
1. COMPRESSOR EQUIPPED WITH AN INTERNAL OVERLOAD PROTECTOR ALLOW TIME FOR RESET
2. VOLTAGE 230/208 -60-3, RANGE: 187-253

Electrical Schematic (continued)

Models UA75AC through UA300AC, 460V through 575V-3PH-60Hz

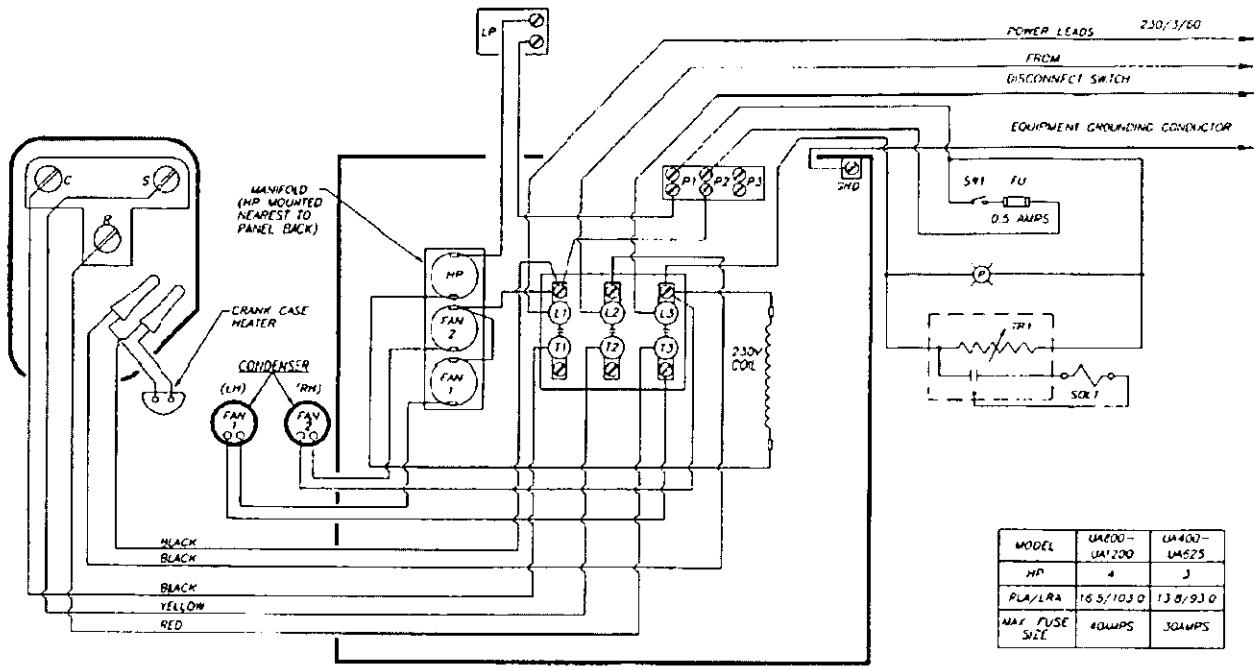


Models UA200AC, 230V-1PH-60Hz



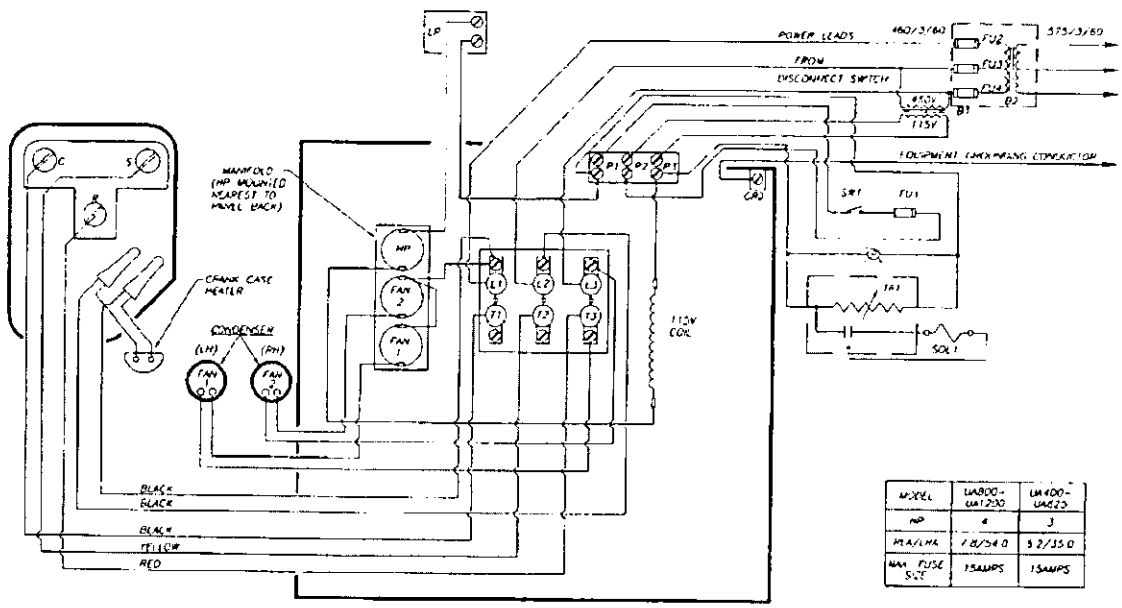
Electrical Schematic (continued)

Models UA400AC through UA1200AC, 230V-3PH-60Hz



MODEL	UA800-UA1200	UA400-UA625
HP	4	3
RLA/LRA	16.5/103.0	13.8/93.0
MAX FUSE SIZE	40AMPS	30AMPS

Models UA400AC through UA1200AC, 460V through 575V-3PH-60Hz



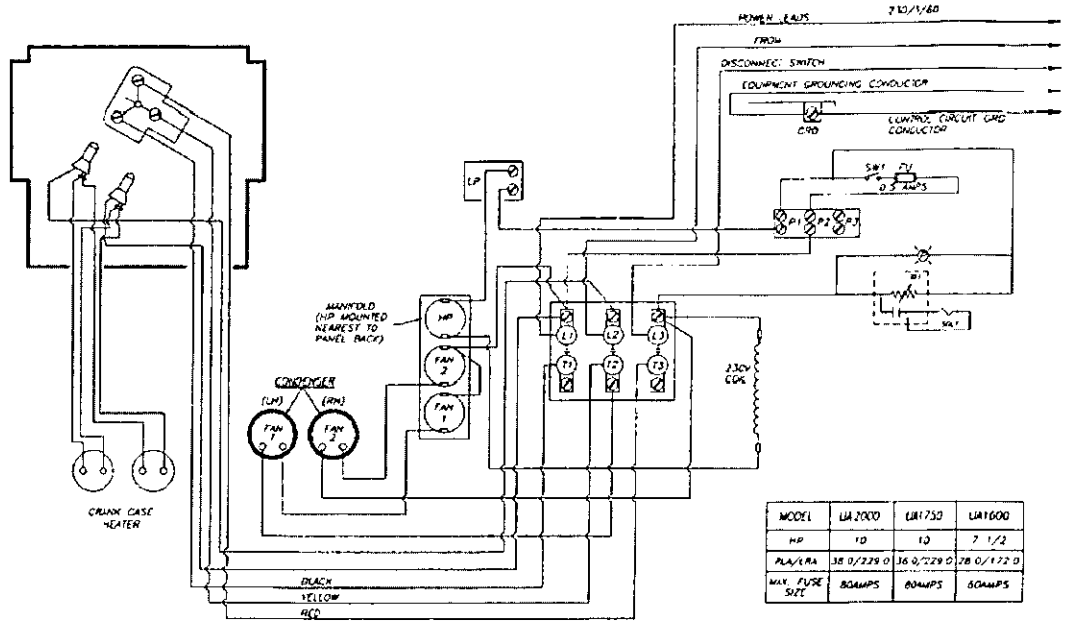
MODEL	UA800-UA1200	UA400-UA625
HP	4	3
RLA/LRA	7.8/54.0	5.2/35.0
MAX FUSE SIZE	15AMPS	15AMPS

SW1 - COMPRESSOR ON/OFF
SOL1 - SOLENOID VALVE
FU1 - FUSE 0.5 AMPS
B1-2 - TRANSFORMER
FU2-4 - FUSE 15 AMPS
P - POWER ON LIGHT (GREEN)
HP - HIGH PRESSURE SWITCH
LP - LOW PRESSURE SWITCH
TR1 - AUTO DRAIN TIMER

NOTES
1. COMPRESSOR EQUIPPED WITH AN INTERNAL OVERLOAD PROTECTOR ALLOW TIME FOR RESET
2. VOLTAGE 460-60-3, RANGE 414-505

Electrical Schematic (continued)

Models UA1600AC through UA2000AC, 230V-3PH-60Hz

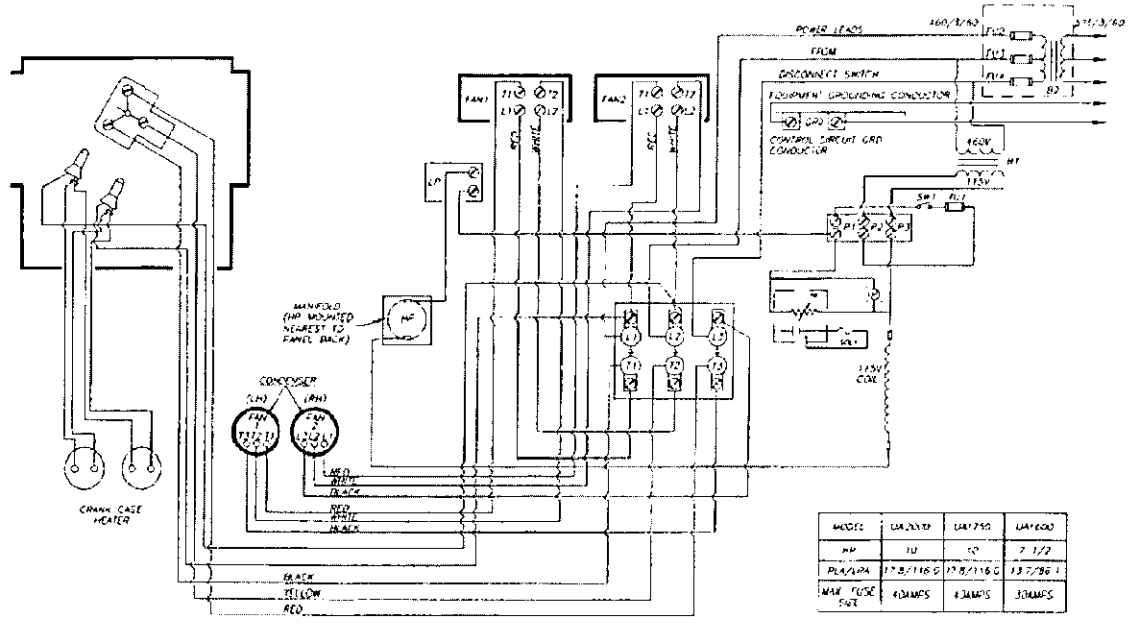


MODEL	UA2000	UA1750	UA1600
HP	10	10	7 1/2
FLA/LRA	38.0/229.0	36.0/229.0	28.0/172.0
MAX. FUSE SIZE	80AMPS	80AMPS	60AMPS

SW1 - POWER ON/OFF
FU - FUSE
SOL1 - SOLENOID VALVE
HP - HIGH PRESSURE SWITCH
P - POWER ON LIGHT
TR1 - AUTO DRAIN TIMER
LP - LOW PRESSURE SWITCH

NOTES:
1 COMPRESSOR EQUIPPED WITH AN INTERNAL OVERLOAD PROTECTOR ALLOW TIME FOR RESET
2 VOLTAGE: 230/208-60-3, RANGE: 180-253

Models UA1600AC through UA2000AC, 575V-3PH-60Hz



MODEL	UA2000	UA1750	UA1600
HP	10	10	7 1/2
FLA/LRA	17.8/116.0	17.8/116.0	13.7/86.1
MAX. FUSE SIZE	40AMPS	40AMPS	30AMPS

SW1 - POWER ON/OFF
FU1 - FUSE 0.5 AMPS
BT-2 - TRANSFORMER
HP - HIGH PRESSURE SWITCH
FU2-4 - FUSE 10 AMPS
P - POWER ON LIGHT
TR1 - AUTO DRAIN TIMER
SOL1 - SOLENOID VALVE
LP - LOW PRESSURE SWITCH

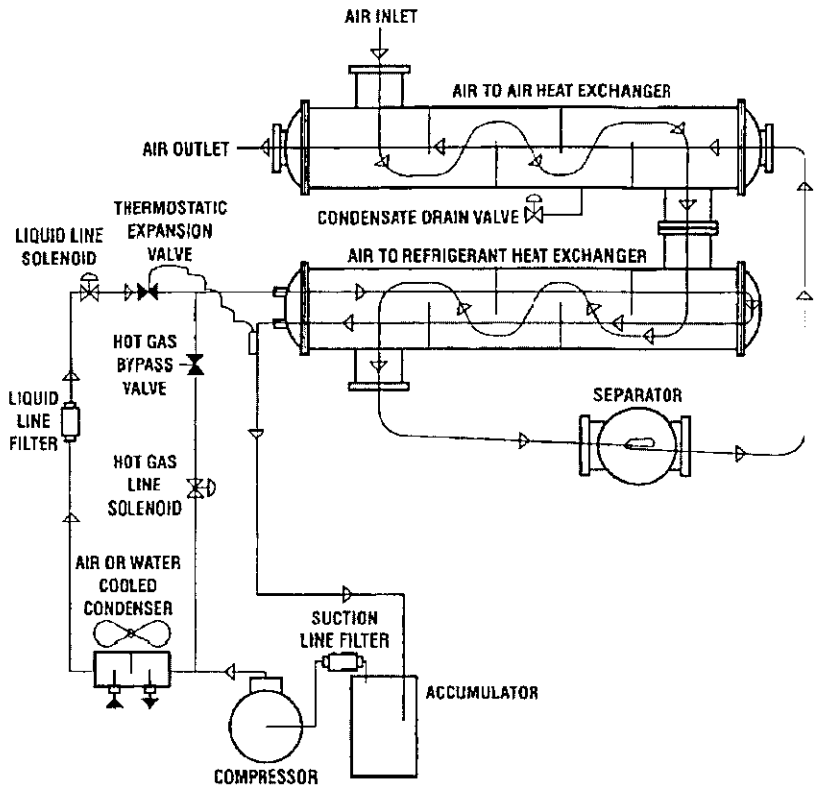
NOTES:
1 COMPRESSOR EQUIPPED WITH AN INTERNAL OVERLOAD PROTECTOR ALLOW TIME FOR RESET
2 VOLTAGE 460-50-3, RANGE 414-506

Refrigeration Circuit Flow Diagram

There are two (2) basic sections, commonly referred to as the high and low pressure sections, in a refrigeration circuit. The high side begins at the refrigerant compressor discharge port and ends at the expansion valve. The circuit leaving the expansion valve through the air to refrigerant heat exchanger and up to the compressor suction port is known as the low pressure circuit.

The compressor takes in low pressure refrigerant gas and compresses it to a high pressure or high temperature gas. The high temperature gas passes into the refrigerant condenser where it is cooled and liquefied. The refrigerant then passes through the filter dryer where moisture and any foreign particles are removed.

The refrigerant then passes through an expansion valve where the liquid refrigerant is throttled and a temperature drop will occur as part of the liquid turns into gas. The cold refrigerant gas and liquid then enters the refrigerant-to-air heat exchanger where it absorbs the heat from the compressed air as it evaporates. The low pressure refrigerant gas returns to the compressor for repetition of the process.



Load Control

The expansion of the refrigerant is controlled by a thermal expansion valve. The expansion valve responds to the suction temperature; As the suction line temperature increases, the expansion valve is opened to allow more liquid refrigerant to feed into the evaporator. This increased volume of liquid causes a greater cooling effect. The suction temperature drops and the valve throttles back. In addition, the circuit incorporates a hot gas bypass valve. This valve feeds a small amount of high temperature gas from the high side directly into the air refrigerant heat exchanger to enable easier control of the dryer at light or no load conditions. As the load increases, the evaporator temperature and pressure begin to rise. The increase of temperature causes the expansion to open and let more refrigerant into the evaporator. As this occurs, the increased pressure causes the hot gas valve to close. This will continue until the dryer is operating at full load at which time the expansion valve has full control and the hot gas valve is closed.

General Information

The Numatics refrigerated air dryer is a constantly running, non-cycling type with a hermetic type refrigeration compressor and is available with a water cooled or air cooled condenser.

The following are the five phases that take place in the drying process:

Phase 1 - Precooling

Air enters the precooler traveling in the opposite direction as the outgoing refrigerated air. The tubes that contain the incoming air are surrounded by the colder, outgoing air.

Phase 2 - Preseparation

As the air is precooled, some of the moisture condenses. During this phase, all condensed moisture and oil is separated from the compressed air.

Phase 3 - Chiller

The air then enters the chiller shell where it passes over the refrigeration tubes. The air stream is cooled to 35-39°F (1.6-3.8°C), reducing its dewpoint to the same temperature.

Phase 4 - Separation

As the air is cooled in the chiller, the moisture condenses into a liquid. At this point, all liquid and oil is separated from the air and drained away with an automatic draining device.

Phase 5 - Reheating

The cold air enters the reheater shell at 35-39°F (1.6-3.8°C) where it passes over the tubes containing incoming hot air. The cold air is reheated to within 20 to 25°F (-6.6 to -3.8°C) of the inlet air temperature.

Controls

A. High-low refrigerant cut-out switch

High side setting: R22 - 350 cut-out, Low side setting: R22 - 50 cut-out

Cut out switch senses high and low refrigerant pressure at refrigerant compressor inlet and outlet ports.

B. Dryer/filter

Filters refrigerant of moisture and any foreign particles. Must be replaced if refrigerant system has maintenance performed on it.

C. Sight glass

Located in the liquid line, indicating liquid refrigerant levels and moisture content.

D. Expansion valve

Senses "low side" (or suction) pressure (temperature). Meters refrigerant flow in the evaporator.

E. Water-regulating valve (water cooled units only)

Senses compressor discharge pressure, regulates water flow to maintain an average 105°F (40.5°C) condensing temperature. Setting is reflected.

F. Electronic drain valve

An electrically controlled solenoid valve is programmed to open and close to automatically drain away condensate.

G. Crank case heater

A safety device which prevents refrigerant migration back to the compressor during shutdown.

H. Hot gas bypass valve

Passes high side gas to low side to maintain a constant suction pressure after first and second step unloading.

Panel Mounted Gauges

A. Refrigerant suction pressure

Indicates pressure on low side of refrigerant compressor. R134a units normally indicate between 30-32 PSIG (2-2.2 bar). R22 units normally indicate between 60-64 PSIG (4.1-4.4 bar). Range of gauge 30" vac/150 PSIG (10.3 bar).

B. Refrigerant discharge pressure

Indicates pressure on the high side of the refrigerant compressor. R22 water cooled units normally indicate 210-245 PSIG (14.4-16.8 bar). Air cooled units normally indicate 225-265 PSIG (15.5-18.2 bar). R134a air cooled units indicate 115 PSIG (8 bar).

Indicating Lights

See electronic control panel on page 12.

Water Cooled Models

Cooling water is required for water cooled shell and tube refrigerant condensers. The user is responsible for piping the water to and from the condenser. Water connections are shown in Figures 1a and 1b. Piping to these connections depends on cooling water temperature. If city water (generally lower in temperature) is used, plug the center connections and connect piping as in Figure 1a. If tower water (generally higher in temperature) is used, connect piping as in Figure 1b, using both city-water connections as inlets and the center connection as the outlet. When cooling water is connected this way, water flow is divided through the tubes, reducing water velocity and pressure drop for more effective cooling.

Water connections for city

For city water (open system) high pressure applications, the tower connection is plugged.

Water connections for tower

For tower usage and low pressure applications, both normal water connections will be used as inlets and the tower connection as an outlet.

The required water flow depends on the water temperature (refer to Table 2). A valve supplied with the dryer automatically adjusts the flow to compensate for variations in water temperature, water pressure, and dryer air load.

Cooling water pressures below or temperatures above those listed in Table 2 may reduce drying capacity. The refrigerant discharge pressure control will shut down the refrigerant compressor if cooling is inadequate.

If the cooling water is dirty, install a strainer ahead of the condenser inlet. Install shut-off valves so that the strainer can be drained and cleaned at regular intervals.

Figure 1a

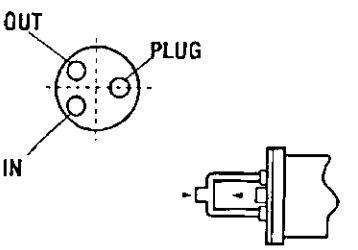


Figure 1b

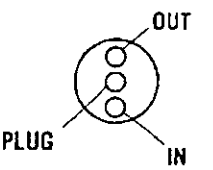


Table 2

Model	*H.P.*	*Water connect.*	*Water req., GPM City (75°F)*	*Tower (85°F)*
200	1	3/8 FPT	3.2	6.3
250	1 1/2	3/8 FPT	5.4	11
300	1 1/2	3/8 FPT	5.4	11
400	2	1/2 FPT	11	22
500	3	1/2 FPT	11	22
625	3	1/2 FPT	11	22
800	4	3/4 FPT	16	33
1000	6	3/4 FPT	16	33
1200	6	3/4 FPT	16	33
1600	7 1/2	1 FPT	20	40
1750	10	1 FPT	24	40
2000	10	1 FPT	24	40

Air cooled models

Cooling air flows from the front to the back of the dryer. Air must be drawn from a clean source in order to reduce dust and dirt accumulation on the condenser coils. Air temperature should not exceed 100°F (38°C).

Fan motor rotation check (this check applies only to air cooled models)
Locate the rotation decals. These may be on each motor or on the condenser. Observe the refrigerant compressor cooling fans. Rotation should be in accordance with the fan rotation shown on the decals. Cooling air should exhaust through the condenser coils away from the fan motors. If the motor rotation is not correct, turn off the power switch and put the main power supply disconnect in the **off** position; lock and tag. Check the wiring and correct the wire lead locations. Recheck for correct rotation.

WARNING

Disconnect electrical services from the unit whenever it is necessary to make adjustments on timers or when servicing drain valves.

Initial Startup Procedures

The following procedure must be followed. Failure to do so could damage your dryer and invalidate the warranty. Before starting...

1. Be sure dryer 'on/off' switch is in the 'off' position or the dryer is unplugged.
2. If refrigerant gauges read below 40 PSIG (2.75 bar), do not start the dryer. Contact your Numatics or Ultra Air distributor or the factory directly.
3. Make sure the air inlet and outlet piping is piped correctly and piping is supported correctly. Do not use the dryer in and out connections as supports.
4. Make sure condensate lines are run properly and to the correct locations.
5. Set drain 'on' and 'off' times. During periods of high humidity it is recommended that 'off' time is decreased and 'on' time is increased. During periods of low humidity, increase 'off' time and decrease 'on' time.
6. Check that there is adequate ventilation on all air cooled units.
7. Make sure cooling water is being supplied to the unit.
8. Confirm proper inlet air pressure, temperature, and flow to the dryer.
9. Turn on disconnect. This will energize crankcase heater(s). Allow the unit to stand for 24 hours before continuing.
10. Check lights. The 'power on' lights should be lit.
11. Pressurize the unit by opening the air inlet valve with the bypass valve open and the air outlet valve closed.
12. Press the 'on' button (colored black). The 'compressor on' light will illuminate and the compressor will start. Shortly after startup, the suction press gauge will read 58-68 PSIG on R22 units or 30-32 PSIG for R134a units.
13. Open the air outlet valve to pass through dryer and close the bypass valve.

Shutdown Procedures

1. Press the red 'off' button.
2. 10-15 units after the unit shuts down, cooling water can be shut down.
3. Turn off main disconnect if necessary.

Air Cooled Condenser Maintenance Procedures

Air cooled condensers may be cleaned by blowing clean with a compressed air blow gun or by steam cleaning. Steam cleaning may be necessary for heavy deposits. Do not use wire brushes as the may bend the fins, causing leaks. Straighten bent fins and fan blades.

Recommended service interval is 1000 hours of operation. More frequent service may be required in dryer is located in a dusty or dirty area.

Ambient air filters are required for dryers located in an excessively dusty or dirty environment.

Water Cooled Condenser Maintenance Procedures

The tube and shell condensers used on all Numatics water cooled dryers are designed for easy cleaning. Both end caps are removable to give direct access to water tubes. Calgon Corporation, a division of Merck & Company, manufactures a scale disolver which can be pumped through the water tubes. As this acid dissolves, the scale bubbles. Once the bubbling stops, scale has been removed. It may be necessary to use a combination of acid and scale disolver with a brush.

A rifle or shotgun brush is ideal when a brush is needed. In such cases, it is recommended that the scale disolver be pumped through the water side and followed with a brush cleaning.

For optimal performance, it is important that the water cooled condenser be cleaned regularly, ideally every 2000 hours of operation.

WARNING

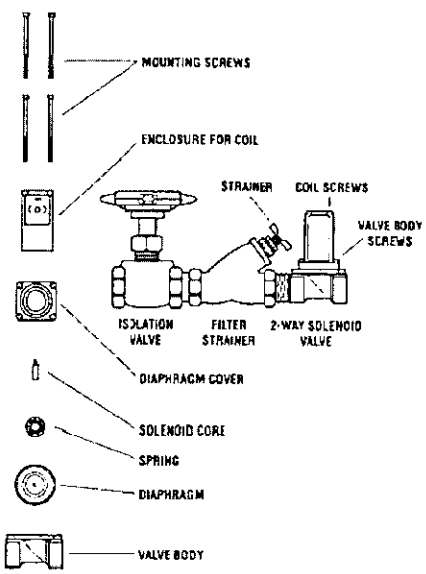
Dryer failure resulting from a dirty condenser is not covered under warranty.

Auto Drain Information

All UA Series high capacity dryers are equipped with two electronic auto drain valves. One is located on the air-to-air heat exchanger and drains condensate in the precooling phase. The other is located under the separator and drains condensate removed by the separator. The open and close time on the drains can be adjusted using the drain open and closed buttons on the electronic control panel (see 'Electronic Control Panel' section on page 15 for instructions).

Maintaining the auto drain

1. Turn dryer on/off switch to 'off' position
2. Disconnect power supply to the dryer
3. Lockout and tag power supply in accordance with OSHA regulations
4. Close isolation valve
5. Remove filter strainer and clean
6. Remove coil screws and coil
7. Remove valve body screws and valve body
8. Remove debris in the valve body
9. Remove diaphragm and inspect for damage or contaminant
10. Remove debris under diaphragm
11. Clean all parts, replacing if necessary
12. Check electrical continuity across coil
13. Reassemble valve and test, using the test button on the electronic control panel



Troubleshooting

Problem: Liquid moisture downstream of dryer

Symptom	*Possible cause*	*Solution*
Inlet air temperature too high	1. Aftercooler failure 2. Aftercooler outlet temperature above 120°F (49°C)	1. Clean/repair aftercooler 2. Check size and capacity against actual conditions
Drain not draining condensate	1. Drain valve not opening	1. Check drain electrical connections, make sure timer is working properly and if valve is receiving signal, check valve for clogging 2. Clean valve, replace timer, replace valve if needed
High air flow through dryer	1. Undersized dryer	1. Reduce airflow 2. Replace with larger dryer
High pressure drop across dryer	1. Too much air flowing through dryer 2. Air freezing in air-to-refrigerant heat	1. Reduce airflow 2. Replace with larger dryer 3. Adjust hot gas bypass valve
Refrigerant compressor off from high refrigerant discharge pressure	1. Condenser coils clogged or flattened 2. Fan motor failure 3. Aftercooler air discharge blowing on condenser 4. Inlet compressec air temp. too high 5. Air in refrigerant system 6. Ambient temp. tco high for aircooled condenser	1. Clean coils and straighten fins 2. Replace fan motor 3. Change aftercooler air flow 4. Reduce dryer inlet temp. to 120°F (49°C) max. 5. Contact certified refrigeration mechanic to repair leak 6. Improve ventilation in compressor room
Compressor cuts out; short cycles on internal overload	1. Refrigeration leak 2. Refrigeration control valves need adjusting 3. improper ventilation for aircooled condenser 4. Improper cooling water flow or temp. to condenser 5. Low voltage	1. Contact certified refrigeration mechanic to repair leak 2. Contact certified refrigeration mechanic to repair leak 3. Improve ventilation and/or clean condenser. Compressor should restart automatically 4. Improve and ensure proper water flow and temp. 5. Contact electrician for repair.
Compressor will not start	1. Compressor windings opened or shortened 2. Compressor burned out 3. Internal mechanical failure	1. Contact certified refrigeration mechanic for repair 2. Replace compressor 3. Contact certified refrigeration mechanic for repair
High evaporator temperature light on; refrigerant suction gauge on "0" PSIG	1. Refrigeration leak 2. Hot gas bypass valve out of adjustment	1. Contact certified refrigeration mechanic to repair leak 2. Adjust hot gas bypass valve by turning clockwise 1/2 turn until suction pressure is between 31-37 PSIG (R134a reference)
Refrigeration suction temp. above 65°F (18°C)	1. Inlet air temp. higher than 120°F (49°C) 2. Hot gas bypass valve out of adjustment 3. Refrigerant leak	1. Check aftercooler operation 2. Adjust hot gas bypass valve by turning clockwise 1/2 turn until suction temp. lowers to 28°F (-2°C) 3. Contact certified refrigeration mechanic to repair leak
Refrigeration discharge temp. lower than 145°F (63°C)	1. Dryer located in a low ambient 2. Refrigerant leak	1. Contact your Numatics distributor 2. Contact certified refrigeration mechanic to repair leak
Refrigerant discharge temp above 250°F (121°C)	1. Dryer located in a high ambient 2. Inlet air temperature too high 3. Fan motor failure 4. Fan motor not running	1. Contact your Numatics distributor 2. Reduce temp. to design conditions 3. Contact certified refrigeration mechanic for repair 4. Check fan cycling switches

Problem: Drain valve not discharging moisture

Symptom	*Possible cause*	*Solution*
Valve continuously purges compressed air	1. Clogged valve 2. Timer board failure 3. Solenoid valve failure	1. Clean valve 2. Replace timer board 3. Replace solenoid valve
Valve not opening	1. No power 2. Timer board failure 3. Solenoid valve failure	1. Check power supply and connections 2. Replace timer board 3. Replace solenoid valve

Problem: Drain valve not discharging moisture (continued)

Symptom	*Possible cause*	*Solution*
No response to drain test button	1. No electrical power 2. Timer board malfunction	1. Check power supply and connections 2. Replace timer board

Problem: Float drain will not seal

Symptom	*Possible cause*	*Solution*
Constant air flow through drain tube	1. Clogged or defective float	1. Clean or replace float

Problem: Dryer blows fuses

Symptom	*Possible cause*	*Solution*
Fuses blow at startup	1. Loose or defective wiring	1. Contact electrician to inspect and repair

Problem: Digital readout not working

Symptom	*Possible cause*	*Solution*
Readout shows "ERR" for temperature reading	1. Corresponding temperature probe is opened or shorted	1. Check probe connections or replace probe
Display blank or erratic	1. No power to board or blown T-630 mA fuse 2. Defective control board	1. Check power supply to control board and replace fuse if needed 2. Replace control board

NOTE: In case of internal freezing, the pressure regulator or hot gas bypass may need adjusting. To do this, remove the dryer top panel and turn the adjuster screw counterclockwise in half-turn increments. If water is present, turn the adjuster screw counterclockwise in half turn increments. Allow 15 minutes between adjustments to permit system to stabilize. Adjusting this valve lowers or raises the suction temperature. See panel mounted gauge section to determine what readings should be.

Warranty

Initial Warranty All Refrigerated Air Dryers manufactured by Numatics Inc. are warranted to be free from defective materials and workmanship for a period of two (2) years from the date of shipment provided the equipment has been properly maintained and used in accordance with instructions found in this manual.

Numatics liability is limited to repair of, refund of purchase price paid for, or replacement in kind at the sole discretion of Numatics Inc. In no event shall Numatics Inc. be held liable or responsible for incidental or consequential damages, even if the possibility of such damages have been made know to Numatics Inc.

The following procedure supplements the above stated warranty:

1. When larger models require warranty service, contact the factory, describing the malfunction. The factory will then provide a service technician or authorize procurement of the services of a competent local refrigeration outlet. Unauthorized service claims will be disallowed.
2. Customer responsibility includes the following routine preventative maintenance:
   - A. Keeping condenser clean
   - B. Keeping heat exchanger clean
   - C. Providing proper ventilation in the area
   - D. Keeping automatic drain clean
   - E. Maintaining proper volume and pressure (and temperature with water cooled condensers)
   - F. Maintaining proper electrical requirements
   - G. Removal or corrosive elements from the compressed air and atmosphere

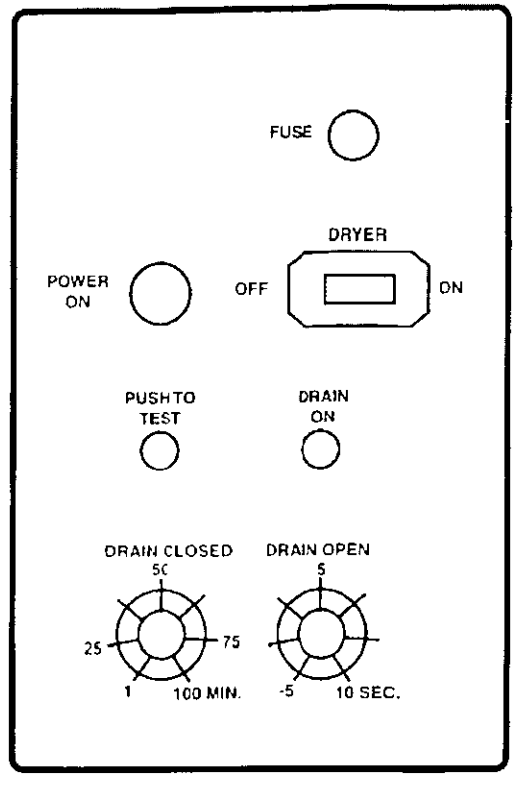
NOTE: When a factory technician is requested for service due to one or more of the above, the customer will be invoiced on a non-warranty service call basis

Standard Control Panel

UA Dryers come standard with a control panel that allows you to control the following operations and gives the following indications:

1. Dryer on/off
2. Power on light
3. Compressor on light
4. Drain open light
5. Drain push to test button
6. Drain closed adj. time 1-100 minutes
7. Drain closed adj. time .5-10 minutes
8. Control circuit fuse

The optional electronic control panel provides additional temperature readouts and adjustments (see below).



Electronic Control Panel

The dryer monitor panel displays one of four temperatures, times the drain valve, and controls the on/off operation at the compressor. The supply voltage to the control panel is 10 V AC and comes from a step down isolation transformer which is separate from the monitor panel.

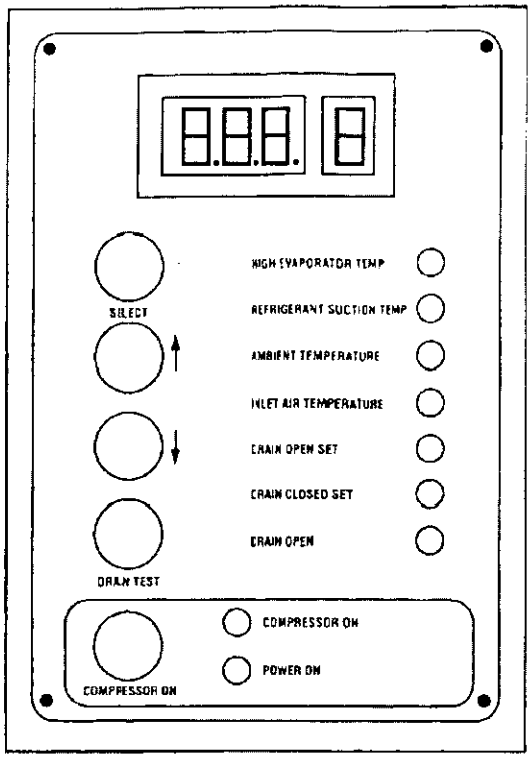
The displayable temperatures are evaporator temp., refrigeration suction temp., and inlet air temp. The displayed temperature is selected using the select switch, causing the corresponding indicator light to light up.. The refrigerant suction temp., ambient temp., and inlet air temp. can be selected and displayed continuously, in degrees Fahrenheit or degrees Celsius (a Celsius readout is achieved by turning on switch 1, located on the back of the panel; a Fahrenheit readout is achieved by turning it off). The evaporator temperature is only displayed for 18 seconds at a time. Additionally, the panel also monitors the evaporator temperature and activates an alarm if it exceeds 70°F (21°C) or if the evaporator temperature is not being displayed, at which point the alarm light flashes. When the evaporator temperature is displayed, the indicator light will be on continuously, regardless of whether or not the evaporator alarm temperature is exceeded. When a sensor becomes defective (open or shorted) or a temperature is out of range (lower than -67°F/-55°C or higher than 302°F/150°C), the corresponding display for that temperature will read "Err".

Each temperature can be calibrated individually. When switch 2 (located on the back of the board) is turned on, it puts the dryer in calibrate mode, causing the temperature display to flicker. The mode select switch is used to select the temperature to be calibrated, using the up and down arrows to select the designated temperature. After calibration is complete, turn off switch 2. The select switch is then used to select the drain open set time, between .5 and 20 seconds.The drain open select time is displayed for 18 second at a time after the time has been selected or after the up or down switch is released.

Use the select switch to select the drain closed set time. The time can be set from 1 minute to 2 hours using the up and down buttons. The drain closed select time can only be displayed for 18 seconds at a time after the time has been selected or after the up and down switch has been released.

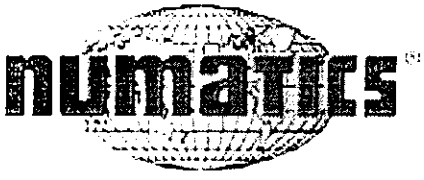
The compressor on switch is used to turn the compressor on and off. The compressor light turns on and the compressor relay activates when the compressor turns on. When the compressor is turned off, the compressor light turns off and the compressor relay is deactivated.

The drain test switch activates the drain relay for the drain open set period. The drain open light turns on when the drain relay is activated.



Operator's Log

Check		Refrigerant Side Checks					Air Side Checks					Auto Drain Valves		Water Side
date	time	ref. suction press.	ref. discharge press.	ref. evap. temp.	ref. suction temp.	comp. oil level	ambient air temp.	inlet air temp.	evap. air temp.	air inlet press.	air outlet press.	air to air drain	air to ref. drain	water inlet temp.



Air Preparation Group
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www.numatics.com

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LTUADRYMAN-1 EAM01/01 xxx-AP-xx/xx

APPENDIX J

QED AP-4 TOTAL FLUID PUMP MANUAL

OPERATIONS MANUAL

QED

Leaders in Environmental Compliance Products

AP-4 AutoPump®

AutoPump Controllerless System
(for 4-inch wells or larger)

PO Box 3726
6095 Jackson Road
Ann Arbor, Michigan 48106-3726

(800) 624-2026 — North America Only
(734) 995-2547 — Tele.
(734) 995-1170 — Fax
info@qedenv.com — E-mail
www.qedenv.com

1133 Seventh Street
Oakland, California 94607

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The equipment in this manual is protected under U.S. and foreign patents issued and pending:

U.S. Patents:	
Selective Oil Skimmer (SOS)	4,497,370
Specific Gravity Skimmer (SPG)	4,663,037
AutoPump (AP)	5,004,405
Specific Gravity Skimmer (SPG) Product Sensing	5,474,685
Vacuum/Pressure Hydrocarbon Recovery System	4,761,225
SPG PSR technology	5,474,685
AP-2	5,641,272
Genie System	5,704,772
Canada Patent:	
Specific Gravity Skimmer (SPG)	1,239,868

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Chapter 3: Equipment 15

Unpacking 15

Equipment List 15

Tools 16

Parts List 16

AP-4 AutoPumps 16
- Bottom-Loading AP-4/BL 16
- Top-Loading AP-4/TL 16
- Specifications 19
- Component Materials 19
- Performance and Air Use Curves 19
- Landfill Pump Configurations 19
  - Landfill Specifications 19
  - Component Materials 19

Single Stage Filter/Regulator 21

Hoses and Fittings 22
- Hose and Tubing Color Code Table 22

Pump Cycle Counter 23
- Volumes Pumped Per Cycle 23

Pump Support System 24

Chapter 4: Assembly & Installation 25

Cautions 25

Compressed Air Supply 26

Component Assembly 26
- Quick-Connects/Hose Barbs 26
- AutoPump Assembly 26

Dry Test 32

Pump Support System and Hose Bundling Assembly 33

AutoPump Installation 38

Chapter 5: Start Up and Operation 41

Start Up Checklist 41

Adjusting the Pump Cycle Counter 42

Observation of System Operation 43

Downwell Testing of the AutoPump 43

AutoPump Shutdown while Submerged 43

AutoPump Removal Technique (optional) 44

Chapter 6: Maintenance 45

General Maintenance 45

Maintenance Table 46

Air Quality Check 46
- Single Stage Filter/Regulator Maintenance 46

AutoPump Service 48
- AutoPump Shutdown and Removal from Well 48
  - For Bottom-loading pumps 48
  - For Top-loading pumps 48
- Removing Pump Casing 49
- Cleaning Pump Interior 51
- Iron Build-up Cleaning Procedure 58
- Installing Pump Casing 59

Cleaning the Pump Cycle Counter 61

Checking Volumes Pumped Per Cycle 62

Chapter 7: Troubleshooting & Repairs 63

Troubleshooting 64

000220

Returning Equipment for Service 67

Equipment Cleaning Requirements 68
Hoses and Fittings 68
AutoPumps 68

Appendix A: Performance Curves 69

Appendix B: Air Consumption Curves 91

Appendix C: AP-4 Conversions 105

Appendix D: Vacuum on Well 109

Appendix E: Air Compressor 115

Installation 115
Electrical Wiring for the Compressor 116
Motor Overload Protection 117
Air Quality and Pressure 117

Maintenance 118

Troubleshooting 119

Appendix F: Pump Cycle Counter 121

Introduction 121
Adjusting the Pump Cycle Counter 124
Cleaning the Pump Cycle Counter 125
Assembly of the Digital Display 127
AP-4 Volumes Pumped per Cycle 128

Terms, Conditions, and Warranty 129

Figures:

Figure 1 - How it Works 9
Figure 2 - Overview of the AutoPump System 11
Figure 3 - Long and Short Bottom-Loading (AP-4/BL) 17
Figure 4 - Long and Short Top-Loading (AP-4/TL) 18
Figure 5 - Long, Short, and LDD Bottom-Loading Leachate (AP-4/BL) 20
Figure 6 - Single Stage Filter/Regulator 60 with Quick-Connects 21
Figure 7 - Locking Quick-Connects 27
Figure 8 - Two-Ear Clamp and Hose Barb Assembly Instructions 28
Figure 9 - Worm Drive Clamp and Hose Barb Assembly Instructions 29
Figure 10 - AP-4 Assembly with Quick-Connects: Well Cap with Holes 30
Figure 11 - AP-4 Assembly: Well Cap with Hose Barbs 31
Figure 12 - Examples of Well Caps 34
Figure 13 - Hose Bundling: Part 1 of 2 36
Figure 14 - Hose Bundling: Part 2 of 2 37
Figure 15 - Removing AP-4 Pump Casing 50
Figure 16 - Exploded View of a Top-Loading AutoPump AP-4 (Long & Short) 52
Figure 17 - Exploded View of a Bottom-Loading AutoPump AP-4 (Long & Short) 53
Figure 18 - Exploded View of AP-4 Lever Assembly 54
Figure 19 - Exploded View of LDD AutoPump AP-4 55
Figure 20 - Bottom Intake Check Valve Assembly 56
Figure 21 - Exploded View of 1-Inch Brass Check Valve 57

000222

Figure 22 - Long AP-4/BL Performance Curves: 1-inch I.D. Discharge
U.S. UNITS (Includes Leachate Models) 71

Figure 23 - Long AP-4/BL Performance Curves: 3/4-inch I.D. Discharge
U.S. UNITS (Includes Leachate Models) 72

Figure 24 - Long AP-4/BL Performance Curves: 25.4 mm (1-inch) I.D. Discharge
METRIC UNITS (Includes Leachate Models) 73

Figure 25 - Long AP-4/BL Performance Curves: 19 mm (3/4-inch) I.D. Discharge
METRIC UNITS (Includes Leachate Models) 74

Figure 26 - Long AP-4/TL Performance Curves: 1-inch I.D. Discharge
U.S. UNITS (Includes Leachate Models) 75

Figure 27 - Long AP-4/TL Performance Curves: 3/4-inch I.D. Discharge
U.S. UNITS (Includes Leachate Models) 76

Figure 28 - Long AP-4/TL Performance Curves: 25.4 mm (1-inch) I.D. Discharge
METRIC UNITS (Includes Leachate Models) 77

Figure 29 - Long AP-4/TL Performance Curves: 19 mm (3/4-inch) I.D. Discharge
METRIC UNITS (Includes Leachate Models) 78

Figure 30 - Short AP-4/BL Performance Curves: 1-inch I.D. Discharge
U.S. UNITS (Includes Leachate Models) 79

Figure 31 - Short AP-4/BL Performance Curves: 3/4-inch I.D. Discharge
U.S. UNITS (Includes Leachate Models) 80

Figure 32 - Short AP-4/BL Performance Curves: 25.4 mm (1-inch) I.D. Discharge
METRIC UNITS (Includes Leachate Models) 81

Figure 33 - Short AP-4/BL Performance Curves: 19 mm (3/4-inch) I.D. Discharge
METRIC UNITS (Includes Leachate Models) 82

Figure 34 - Short AP-4/TL Performance Curves: 1-inch I.D. Discharge
U.S. UNITS (Includes Leachate Models) 83

Figure 35 - Short AP-4/TL Performance Curves: 3/4-inch I.D. Discharge
U.S. UNITS (Includes Leachate Models) 84

Figure 36 - Short AP-4/TL Performance Curves: 25.4 mm (1-inch) I.D. Discharge
METRIC UNITS (Includes Leachate Models) 85

Figure 37 - Short AP-4/TL Performance Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models) 86

Figure 38 - Low Drawdown AP-4/BL Performance Curves: 1-inch (25.4 mm) I.D. Discharge U.S. and METRIC UNITS 87

Figure 39 - Low Drawdown AP-4/BL Performance Curves: 3/4-inch (19 mm) I.D. Discharge U.S. and METRIC UNITS 88

Figure 40 - Low Drawdown AP-4/TL Performance Curves: 1-inch (25.4 mm) I.D. Discharge U.S. and METRIC UNITS 89

Figure 41 - Low Drawdown AP-4/TL Performance Curves: 3/4-inch (19 mm) I.D. Discharge U.S. and METRIC UNITS 90

Figure 42 - Long AP-4 Air Consumption Curves: 1-inch I.D. Discharge U.S. UNITS (Includes Leachate Models) 93

Figure 43 - Long AP-4 Air Consumption Curves: 3/4-inch I.D. Discharge U.S. UNITS (Includes Leachate Models) 94

Figure 44 - Long AP-4 Air Consumption Curves: 25.4 mm (1-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models) 95

Figure 45 - Long AP-4 Air Consumption Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models) 96

Figure 46 - Short AP-4 Air Consumption Curves: 1-inch I.D. Discharge U.S. UNITS (Includes Leachate Models) 97

Figure 47 - Short AP-4 Air Consumption Curves: 3/4-inch I.D. Discharge U.S. UNITS (Includes Leachate Models) 98

Figure 48 - Short AP-4 Air Consumption Curves: 25.4 mm (1-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models) 99

Figure 49 - Short AP-4 Air Consumption Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models) 100

Figure 50 - Low Drawdown AP-4/BL Air Consumption Curves: 1-inch (25.4 mm) I.D. Discharge U.S. and METRIC UNITS 101

Figure 51 - Low Drawdown AP-4/BL Air Consumption Curves: 3/4-inch (19 mm) I.D. Discharge U.S. and METRIC UNITS 102

Figure 52 - Low Drawdown AP-4/TL Air Consumption Curves: 1-inch (25.4 mm) I.D. Discharge U.S. and METRIC UNITS 103

000224

Figure 53 - Low Drawdown AP-4/TL Air Consumption Curves: 3/4-inch (19 mm) I.D. Discharge U.S. and METRIC UNITS 104

Figure 54 - Conversion From Bottom-Loading to Top-Loading AutoPump for pumps made after 1991 106

Figure 55 - Conversion From Top-Loading to Bottom-Loading AutoPump for pumps made after 1991 107

Figure 56 - AP-4/BL with Vacuum In the Well and Pump Exhaust Outside the Well 110

Figure 57 - AP-4/BL with Vacuum In the Well and Pump Exhaust In the Well 111

Figure 58 - AP-4/TL with Vacuum In the Well and Pump Exhaust Outside the Well 112

Figure 59 - AP-4/TL with Vacuum In the Well and Pump Exhaust In the Well 113

Figure 60 - Pump Cycle Counter 121

Figure 61 - Pump Cycle Counter Installation 123

Figure 62 - Pump Cycle Counter Cleaning and Adjustment 126

Introduction

Welcome to QED Environmental Systems' AutoPump® (AP-4) manual.

To ensure the best operator safety and system performance, it is strongly recommended that the operators read this entire manual before using the system.

This manual reflects our many years of experience and includes comments and suggestions from our sales and service personnel and most importantly from our customers. The chapters, their contents and sequence were designed with you, the user and installer, in mind. We wrote this manual so it can be easily understood by users who may not be familiar with systems of this type or are using a *QED* system for the first time.

Safety

Safety has been a cornerstone of our design which has been proven out in building and shipping systems throughout the world. Our high level of performance is achieved by using quality components, building in redundancies or backup systems, and not compromising our commitment to quality manufacturing. The net result is the highest quality and safest pneumatic pump recovery system on the market. We feel so strongly about safety, based on years of working with the hydrocarbon industry, that it is the first section in all of our manuals.

How to Contact *QED*

If for any reason you are unable to find what you need in this manual please feel free to contact the *QED* Service Department at any time. We encourage you to use following communication methods to reach us at any time:

Service Department
QED Environmental Systems
www.qedenv.com

Oakland Service Center
1133 Seventh Street
Oakland, California 94607

(800) 537-1767 – North America Only
(510) 891-0880 – Tele.
(510) 444-6789 – Fax

Ann Arbor Service Center
PO Box 3726
6095 Jackson Road
Ann Arbor, Michigan 48106-3726

(800) 624-2026 — North America Only
(734) 995-2547 — Tele.
(734) 995-1170 — Fax
info@qedenv.com — E-mail

***QED* can be reached 24 hours a day**

We welcome your comments and encourage your feedback regarding anything in this manual and the equipment you have on-site.

Thank you again for specifying *QED* remediation equipment.

Chapter 1: Safety

Safety has been a prime consideration when designing the AutoPump System. Safety guidelines are provided in this manual, and the AutoPump System safety features are listed below. Please do not attempt to circumvent the safety features of this system.

We have also listed some possible hazards involved when applying this system to site remediation. Nothing will protect you as much as understanding the system, the site at which it is being used, and the careful handling of all the equipment and fluids. If you have any questions, please contact the *QED* Service Department for guidance.

As you read through this manual, you will encounter three kinds of warnings. The following examples indicate how they appear and lists their respective purposes.

Note:	Highlights information of interest.
Caution:	Highlights ways to avoid damaging equipment.
WARNING:	Highlights personal safety issues.

A Partial List of Safety Procedures

WARNING:
The air compressor and any other electrical equipment used with this pneumatic system must be positioned outside of any area considered hazardous because of possible combustible materials.

These safety procedures should be followed at all times when operating QED equipment on or off site, and should be considered as warnings:

- Wear safety goggles when working with the AutoPump System to protect eyes from any splashing or pressure release.

- Wear chemically resistant rubber gloves, boots, and coveralls when handling the AutoPump and fluid discharge hose to avoid skin contact with the fluid being recovered.
- Point all hoses away from personnel and equipment when connecting or disconnecting.
- Always ensure that the fluid discharge hose is connected before the air hose to prevent accidental discharge.

The AutoPump System minimizes the potential for accidents with the following safeguards:

Fire and Explosion Protection

Almost all of QED underground fluid extraction systems are pneumatic. This offers many inherent fire and explosion protection features:

- Compressed air lines eliminates electrical wiring in hazardous areas.
- Aluminum or fiberglass enclosures prevent sparking.
- Standard systems use brass fittings to eliminate sparking hazard.

Personal Protection

On-site, service and maintenance personnel can safely use *QED* equipment. Safety-in-use is the primary design feature in all systems. Following are some samples:

- All standard high pressure air hoses have automatic shut off quick-connects on the supply side which prevents injury due to hose whip or air blown particles. Tubing does not usually have quick-connect fittings, but is pushed over barbs or pushed into compression fittings.
- Metal regulators and filter bowls are rated at 200 psi and plastic bowls are rated at 150 psi. The metal air filter bowl is made of zinc, providing greater pressure and chemical resistance than plastic bowls and it is less prone to damage if dropped. The customer can choose either material.

Spill Protection

On-site spills cannot always be prevented. *QED* equipment is designed to take into consideration such unpredictable occurrences that may happen despite strict adherence to standardized safety practices.

- The standard air and fluid hoses are rated at over 800 psi burst pressure to prevent accidental hose breakage.
- Down well quick-connects have locking features to prevent accidental disconnections.

Chapter 2: Overview

The AutoPump® fills and empties automatically, and is very easy to install, use, and maintain.

The AutoPump is a pneumatic fluid extraction pump that pumps in pulses. It handles any liquid which flows freely into the pump and is compatible with the component materials and with the connecting hoses. The AP-4 is intended for vertical operation in well casings with a 3.75-inch or greater internal diameter. It can pump particles up to 1/8-inch in diameter.

The AutoPump is very versatile and available in a wide range of lengths, valve arrangements, and materials of construction to meet particular site specifications.

Equipment will vary by application and site specifications. (See Chapter 3)

General Specifications

Pump Diameter	3.50 inch	88.9 mm
Pressure Range	5 - 120 psi	0.4 - 8.5 Kg/cm^2
High Pressure Option	5 - 200 psi	0.4 - 14.1 Kg/cm^2
Flow Ranges	0-16 gallons per minute	0-60 liters per minute

This is How it Works

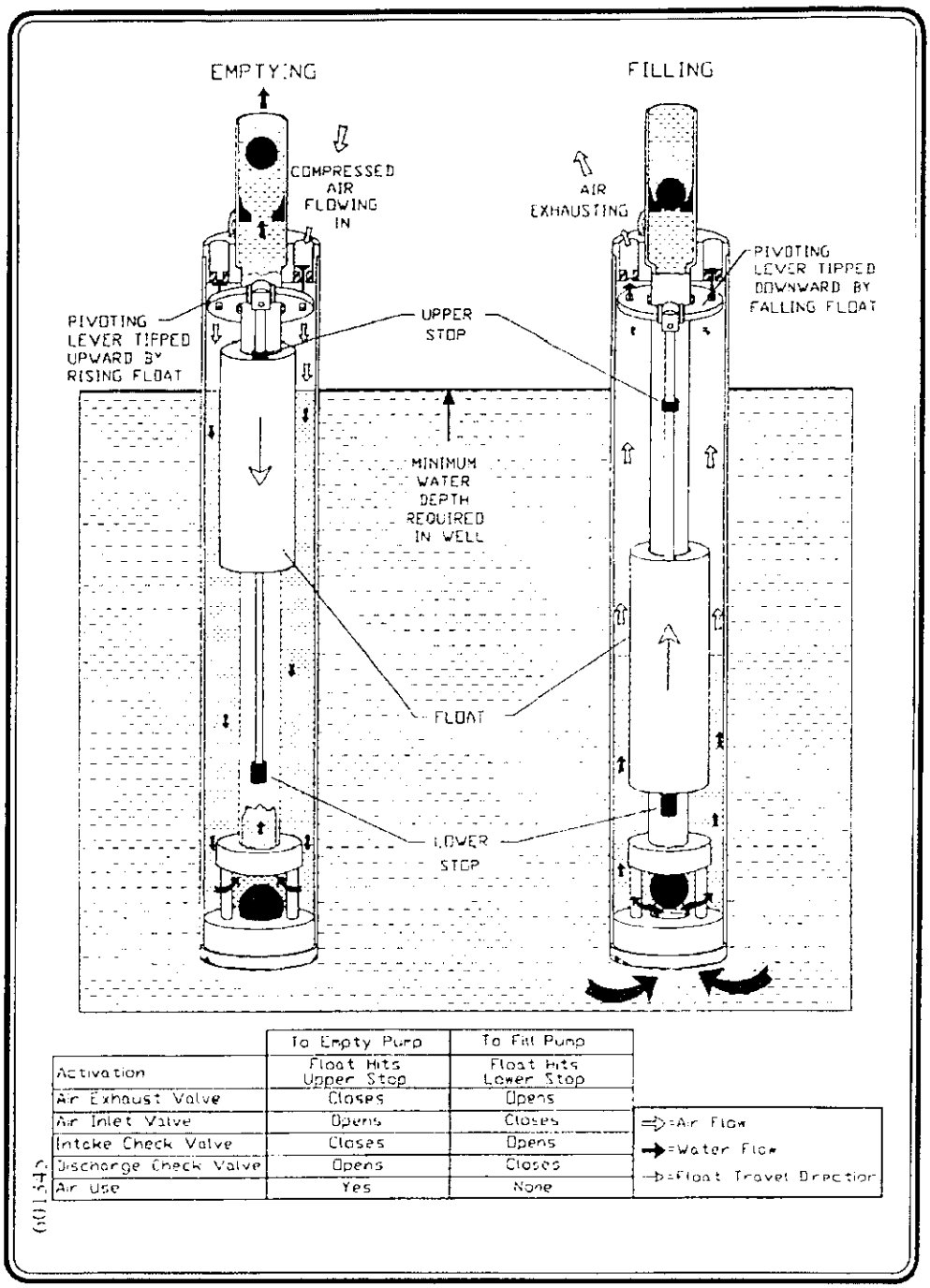
The AutoPump is a submersible compressed air-driven pump which fills and empties automatically. It also controls the fluid level in a well automatically. The pump fills (see Figure 1) when fluids enter either the top or bottom check valve. Air in the pump chamber exits through the exhaust valve as the fluid fills the pump. The float inside the pump is carried upwards by the fluids rising in the casing until it pushes against a stop on the control rod, forcing the valve mechanism to switch to the discharge mode.

The switching of the valve causes the exhaust valve to close and the air inlet valve to open. This causes the pump to empty (**see Figure 1**) by allowing compressed air to enter the pump. This pressure on the fluid closes the inlet check valve and forces the fluids up the discharge tube and out of the pump through the outlet check valve. As the fluid level falls in the pump, the float moves downwards until it pushes against the lower stop on the control rod, forcing the valve mechanism to switch to the fill mode. The outlet check valve closes and prevents discharged fluids from re-entering the pump. The filling and discharging of the pump continues automatically.

Note: The figures shown here are simplified schematics.

Major AutoPump Features

- The AutoPump System is small and lightweight and can be easily moved from site to site, allowing quick response to changing conditions.
- The hoses are color coded and all the fittings are different so only the proper connections can be made.
- Rugged construction ensures long system life, even under harsh conditions.
- The entire system is pneumatically powered with no electrical components, thus avoiding sparks in control power and sensing devices.
- Durable stainless steel air valves that can pass liquids as viscous as 90 weight gear oil without fouling. The air valves can handle reverse flow and submersion for long periods of time. Unlike pumps with bubblers or bleed hoses, there are no problems with start up, clogging, and failure under these difficult conditions when using the AP-4. This results in less downtime and lower training, maintenance, and repair costs.



	To Empty Pump	To Fill Pump
Activation	Float Hits Upper Stop	Float Hits Lower Stop
Air Exhaust Valve	Closes	Opens
Air Inlet Valve	Opens	Closes
Intake Check Valve	Closes	Opens
Discharge Check Valve	Opens	Closes
Air Use	Yes	None

001345

Figure 1 - How it Works

- The AP-4 only uses air while pumping. Unlike systems that rely on bleeding air sensors or timers which pressurize and depressurize the air hoses for each stroke, the air hose for the AP-4 remains pressurized to the pumps at all times. Air compressor power consumption, compressor filter maintenance, and thus operating costs are substantially reduced.

- The AP-4 can be configured to fill from the top or the bottom.

Figure 2 on the next page illustrates an overview of an AutoPump System.

The AP-4 System provides everything required for pumping fluid from a well. QED can also supply the air compressor, if desired.

The system is designed to perform for years and comes with a five year warranty.

Note:
An automatic drain on the compressor is highly recommended since it dramatically decreases air filter maintenance. *QED* can supply an automatic drain.

Caution:
Alteration of the System: Do not change or modify the equipment without the expressed written approval of *QED*.

Special Operating Conditions

Conditions may require adjustment or adaptations to the equipment. Below is a list of some of these conditions, their possible effects, and solutions.

Since every site is different, please contact your QED representative for detailed assistance if needed.

Cold Weather

Moisture in the pneumatic lines can freeze causing problems with the system. Such freezing could result in regulators not reducing the air pressure, valves sticking, and hoses clogging.

Actions To Take

- Use water traps and automatic compressor tank drains. These are available at industrial distributing companies (e.g., W.W. Graingers®).

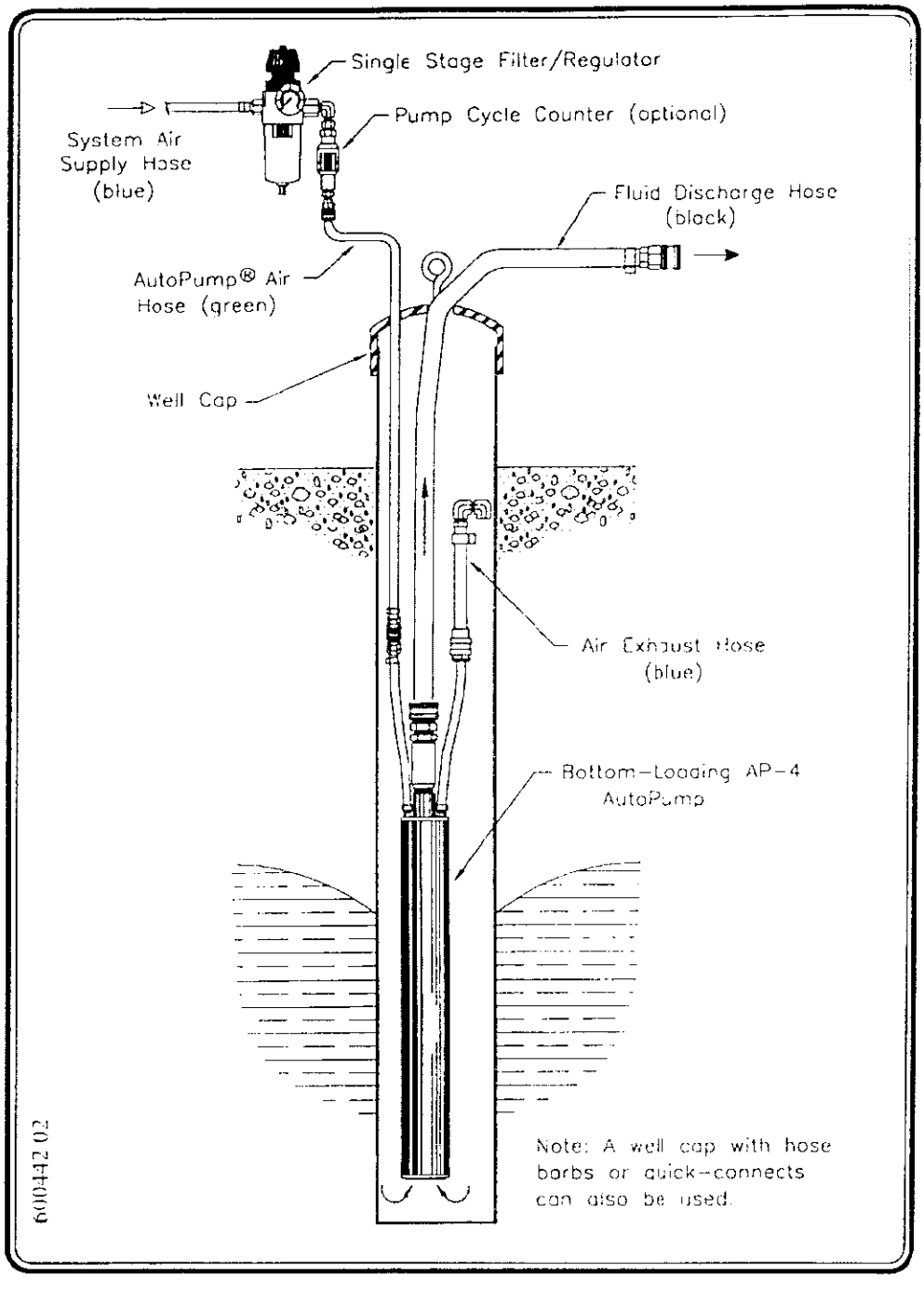


Figure 2 - Overview of the AutoPump System

- Reduce air line freezing by burying air hoses below the frost line, or insulating and heating with heat tape, or running hoses through a PVC pipe with warm air being blown through it.

- Remove all the moisture you can from the air by using drains on the compressor, filter, and low points in the air line. Use an air dryer to lower the dew point of the compressed air below the temperature of exposed lines.

- Protect the air regulator from freezing. During freezing conditions regulators may fail "open", allowing high pressure (e.g. 150 psi from the compressor) to enter components (e.g. gauges, hoses, fluid receptacles) that may be damaged, cause a safety problem, or release contaminating material.

- Locate the air intake to the compressor so the coolest (driest) air is drawn in. Usually it is better to draw air from outside a building than from the inside.

Flow induced freezing

Although it rarely occurs, air flow through an AutoPump may cause freezing at water temperatures well above 32°F, slowing down the system. Cold water, moisture in the compressed air, high air pressure, a high pumping rate, and back pressure on the pump are variables that alone, or in combination with each other, may induce freezing. Should it occur, there are system adaptations which can decrease or eliminate the freezing. Please contact *QED* for advice.

The well is under a vacuum

The pump will work in a well that is under a vacuum, but there are several conditions that must be considered.
(See Appendix D)

Abrasive particles in the well

Please contact QED service if you encounter problems with abrasives in the well.

Hard pipe air supply connection to the pump

These can cause debris and scale to travel down to the pump. It can also prevent the pump from cycling smoothly due to a solid connection (non-flexing) to the top of the pump. Blow out all of the hard pipe before connecting the pump. A short (6 feet) length of hose should be used between the hard pipe and the pump to allow the natural movement of the pump to occur without restraint. A small screen filter should be used at the lower end of the metal air pipe to prevent scale from reaching the air valve.

Other site conditions such as highly viscous fluids, extremes of pH, high salinity, deep (>400 feet) applications, high flow rates for LNAPL application, intermittent air supply, high dissolved solids, and high temperature can also be addressed. Please contact *QED* for guidance.

Options and Accessories

The following options and accessories are available from *QED*. Contact your *QED* Representative regarding the following:

- **AP Data Module** – This water-resistant enclosure protects and shields surface instrumentation from weather and/or harsh site conditions while providing easy visual access to key system instrumentation readings. The options available for inclusion inside the NEMA 3R enclosure are a filter/regulator, pump cycle counter, level sensor regulator and gauge with air flow meter. Also included are a fluid level indicator with an On/Off switch, an Air Inlet Supply Gauge, and a Vacuum/Pressure reference with Gauge.

- **Pump Cycle Counter (PCC)** – A PCC counts the number of times a pump cycles. The counter provides information for maintenance, service, and statistical purposes with minimal loss in air pressure or performance. A PCC is easily attached on the air inlet hose to the pump.

- **Component Materials** - Various materials specifically designed to withstand the harsh well environments (e.g. high temperature, abrasives, highly aggressive chemicals, high viscosity) of particular sites are available for all component pieces.

- **TFSO** – The Tank-Full Shut-Off (TFSO) System is a unique, self-contained pneumatic system that shuts down other pneumatic systems in the event of a liquid level rise or a pressure increase in a container. The TFSO provides dual safety by using two sensors. The system is expandable—the button sensor of the system can be teed to monitor many containers.

- **Inlet Conversions** – AutoPumps can be converted from Top- to Bottom-Loading and visa versa. See **Appendix C** for more information.

000238

Chapter 3: Equipment

Unpacking

During the unpacking procedure, check for the following:

- All parts on the packing list have been included in the box
- All fitting openings are unobstructed
- The equipment has not been damaged in shipment

Equipment List

The equipment list will vary depending on site specifications, but the following list is a typical configuration:.

1. Top-Loading or Bottom-Loading AP-4 with support harness

2. Single stage filter/regulator with:
   - 5 micron filter with auto drain trap
   - Pressure regulator with gauge

3. Pump Cycle Counter (PCC)

4. Hoses:
   - Fluid discharge hose (black)
   - System air supply hose (blue)
   - AutoPump air hose (green)
   - Air exhaust hose (blue)

> **Note:**
> Black nylon tubing can be used in place of hose.

000240

5. Pump support system:
   - Well cap
   - Polypropylene support rope with quick-link assembly or SS wire rope (Alternate materials as required)

Tools

The following tools are used to service the AP-4:
- Spanner wrench

Parts List

In aggressive sites over millions of cycles, the parts that one may anticipate replacing are:
- Discharge check valve ball

AP-4 AutoPumps

In both the Bottom-Loading and the Top-Loading models, the fluid is pushed out of the pump through a check valve located at the top of the pump. This check valve prevents the fluid from reentering the pump.

Bottom-Loading AP-4/BL

The Bottom-Loading AutoPump fills through a check valve at the bottom of the pump. There are three lengths of AP-4/BL: long, short, and low drawdown. The fluid level in the well can be drawn down to 36 inches from the bottom of the long BL, and 25 inches from the bottom of the short BL **(See Figure 3)** and as low as 11.5 inches with the low drawdown configuration **(See Figure 5)**

Top-Loading AP-4/TL

The Top-Loading AutoPump fills through a check valve at the top of the pump, therefore the fluid level in the well will never go below the level of this check valve. There are three lengths of AP-4/TL: long, short **(See Figure 4)** and low drawdown.

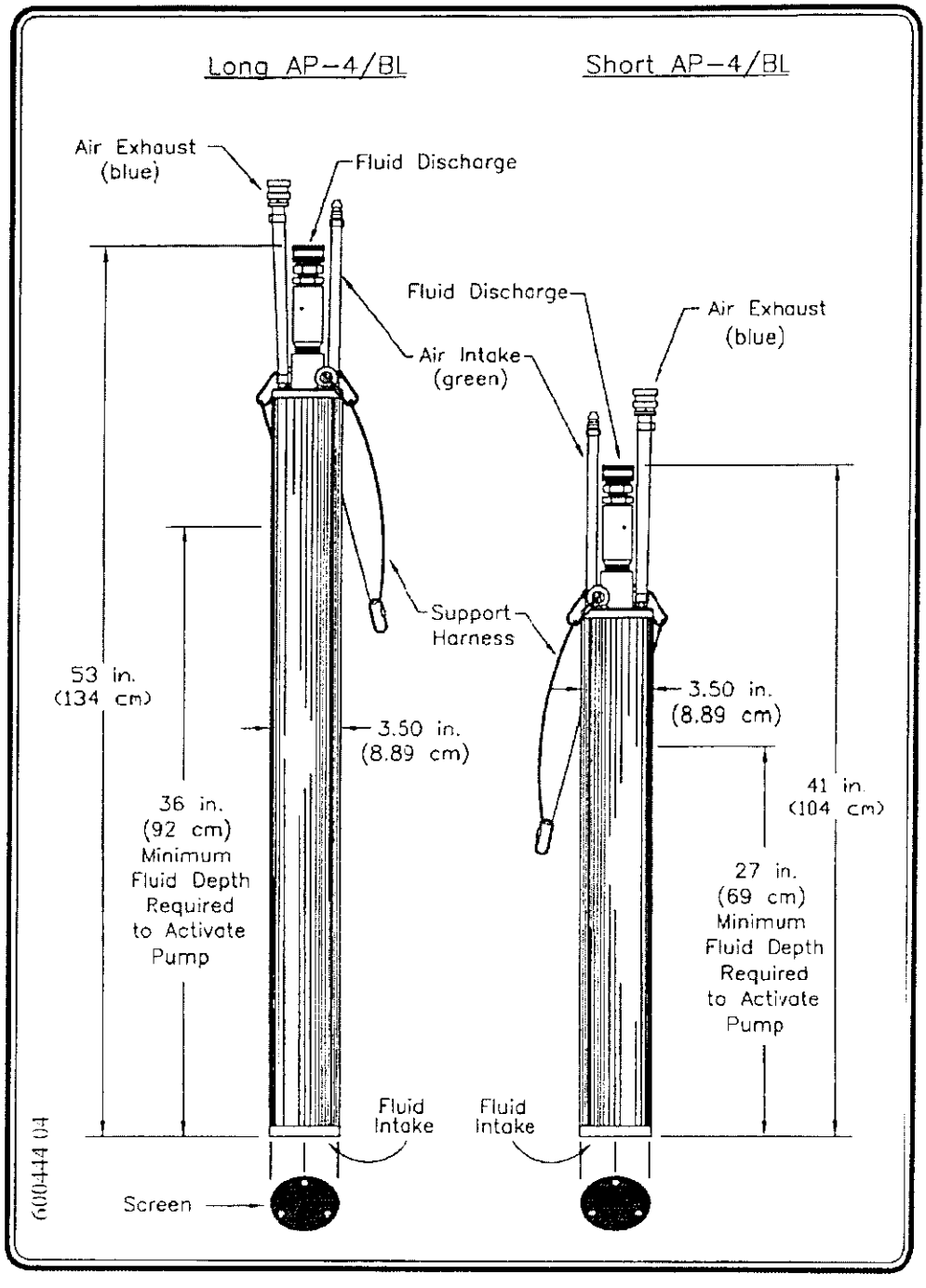


Figure 3 - Long and Short Bottom-Loading (AP-4/BL)

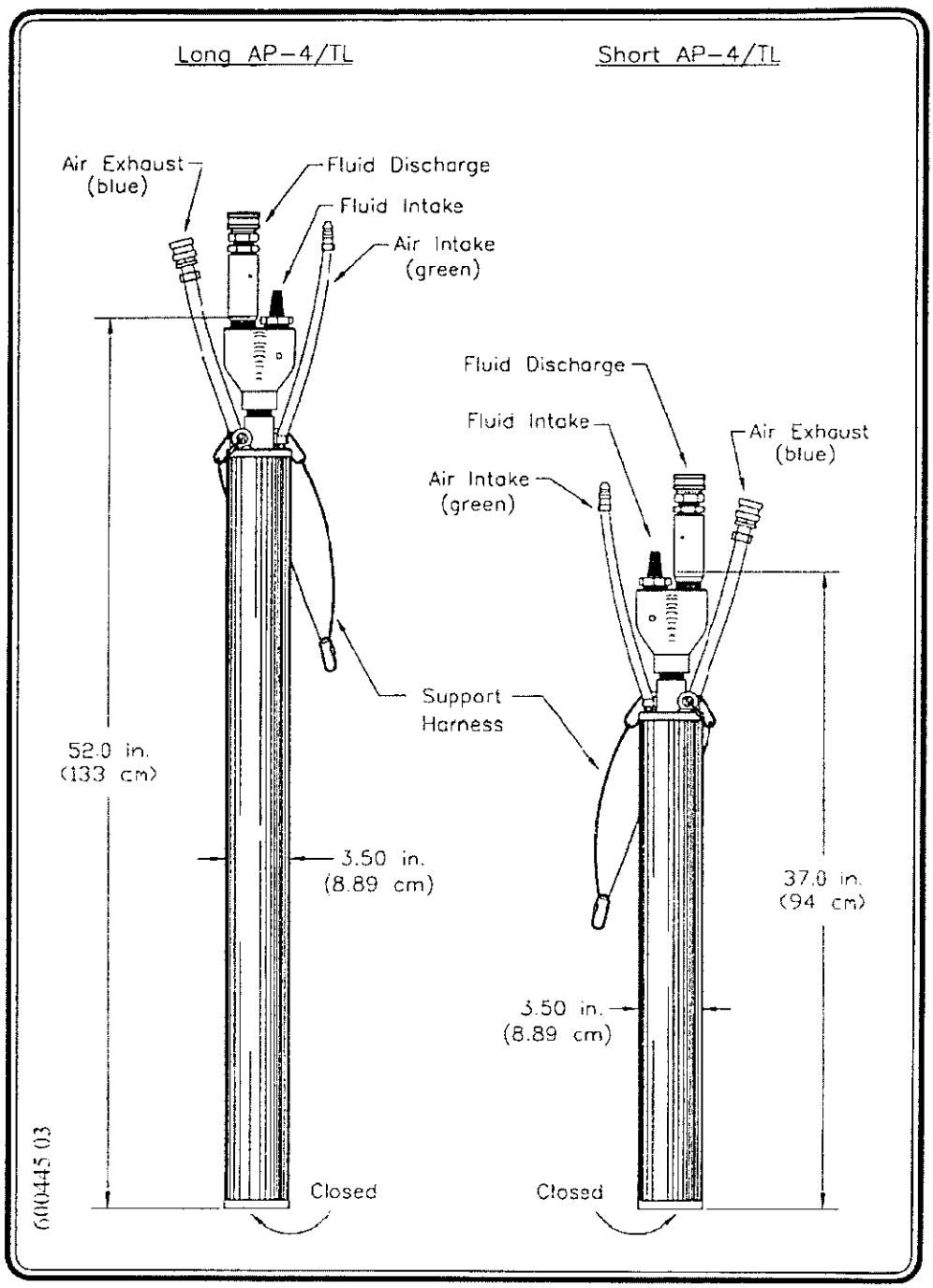


Figure 4 - Long and Short Top-Loading (AP-4/TL)

Specifications

Pump	Length	Vol/Cycle Range	Weight	Outside Diameter
Long AP-4/BL	53-inches 134-cm	.58 gal - .78 gal 2.2 L - 3.0 L	16 lb 7.2 kg	3.5-in 8.89-cm
Short AP-4/BL	41-inches 104-cm	.22 gal - .36 gal .83 L - 1.4 L	13 lb 5.9 kg	3.5-in 8.89-cm
Long AP-4/TL	57-inches 133-cm	.58 gal - .78 gal 2.2 L - 3.0 L	17 lb 7.7 kg	3.5-in 8.89-cm
Short AP-4/TL	42-inches 94-cm	.22 gal - .36 gal .83 L - 1.4 L	14 lb 6.3 kg	3.5-in 8.89-cm

Component Materials

Typical component materials include stainless steel, acetal, Viton, fiberglass, PTFE (Teflon), PVDF (Kynar), UHMW, epoxy, and brass.

Performance and Air Use Curves

See Appendices A and B.

Landfill Pump Configurations

All lengths (Long, Short, and Low Drawdown) and intake configurations (Bottom-Loading) are available in models for landfill leachate, condensate pumping and dewatering applications. **(See Figure 5)**

These models have material options to withstand temperatures up to 212° F (100° C) and pH levels from 1 to 12. Various inlet screen sizes also available.

Landfill Specifications

Pump	Length	Vol/Cycle Range	Weight	Outside Diameter
Long AP-4/BL	56-inches 142-cm	.58 gal - .78 gal 2.2 L - 3.0 L	16.5 lb 7.5 kg	3.5-in 8.89-cm
Short AP-4/BL	44-inches 111-cm	.22 gal - .36 gal .83 L - 1.4 L	13.5 lb 6.1 kg	3.5-in 8.89-cm
LDD	25.5-inches 64.8-cm	0.08 gal - 0.15 gal 0.30 L - 0.57 L	10.4 lb 4.7 kg	3.5-in 8.89-cm

Component Materials

Typical component materials include stainless steel, acetal, Viton, nylon, fiberglass, Teflon (PTFE), PVDF (Kynar), UHMW, epoxy, and brass.

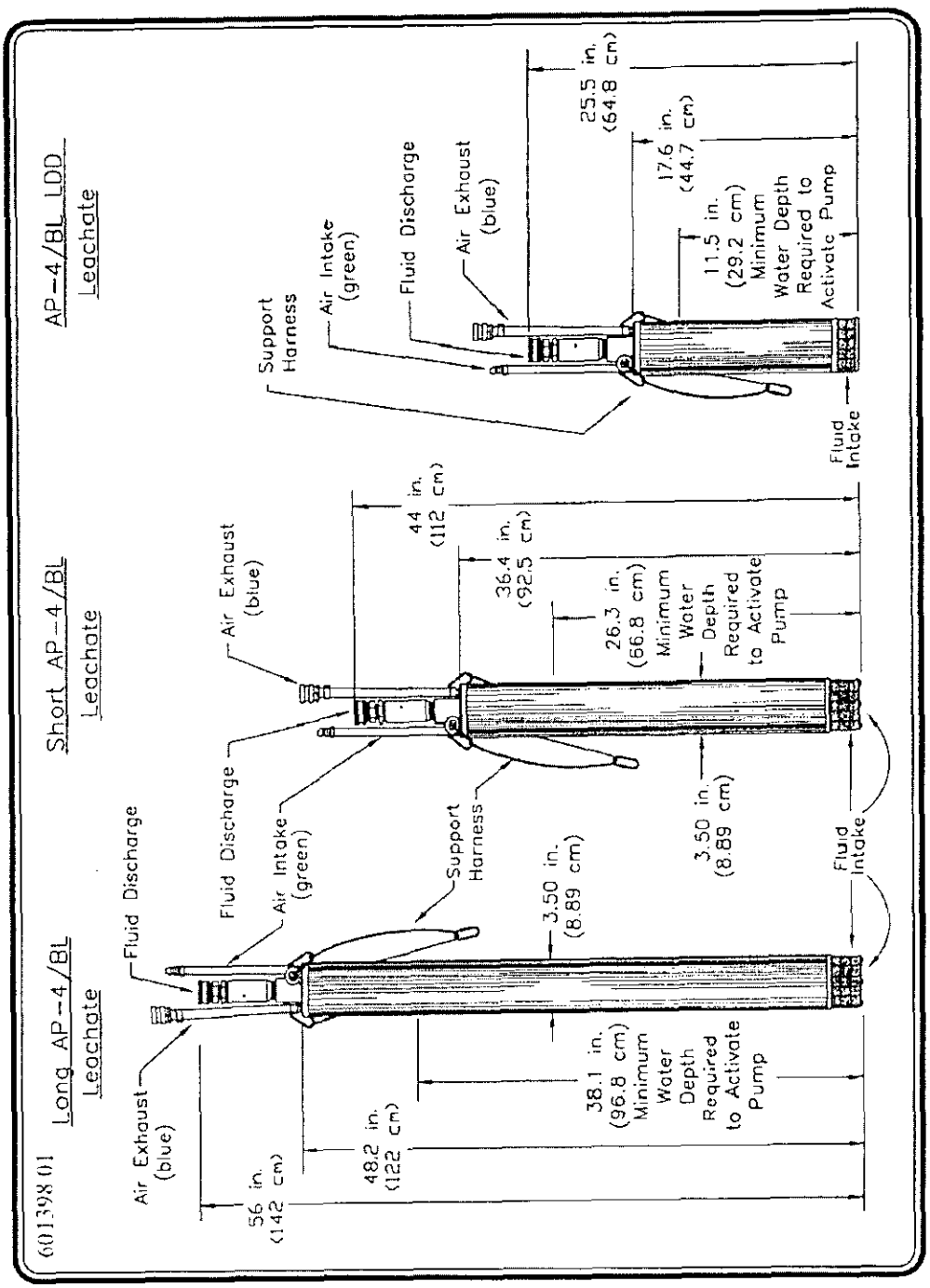


Figure 5 - Long, Short, and LDD Bottom-Loading Leachate (AP-4/BL)

Single Stage Filter/Regulator

A single stage 5 micron particulate air filter/regulator has an a manual or an optional automatic drain and is installed on the system air supply hose. The filter/regulator removes particles and some oil vapor, and water droplets from the air passing to the AP-4. The regulator should produce at least as much pressure as required to move the fluid from the depth at which the pump is installed. **(See Figure 6)**

Note:
Too much air pressure can result in low pump effeciency.

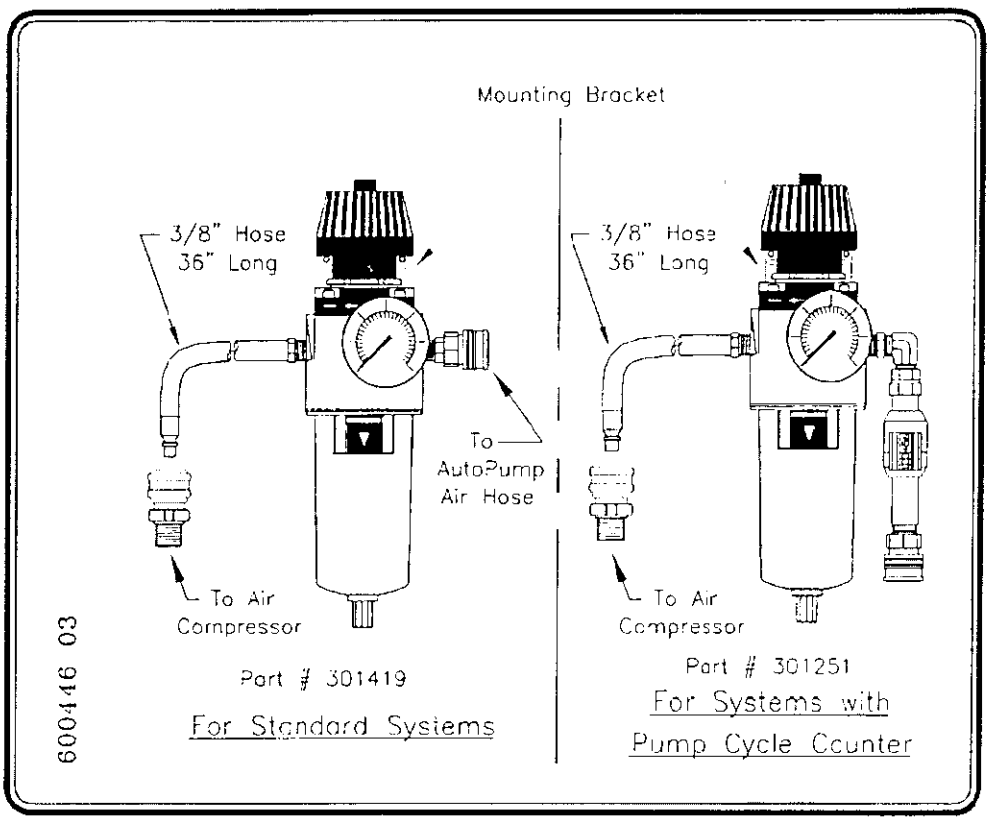


Figure 6 - Single Stage Filter/Regulator 60 with Quick-Connects

Hoses and Fittings

The table below shows the normal hose colors. These may change due to application or need.

Hose and Tubing Color Code Table

	System Air Supply Hose	Fluid Discharge Hose	AutoPump Air Hose	Air Exhaust Hose
Hose Color	Blue	Black	Green	Blue
Hose Material	Nitrile	Nitrile	Nitrile	Nitrile
Hose Size I.D.	3/8-inch to 3/4-inch	5/8-inch to 1-1/4-inch	3/8-inch to 1/2-inch	1/2-inch to 3/4-inch
Tubing Color*	Black	Black	Black	Black
Tubing Material*	Nylon	Nylon	Nylon	Nylon
Tubing Size O.D.*	3/8-inch to 1-inch	5/8-inch to 1-1/4-inch	3/8-inch to 5/8-inch	5/8-inch to 1-inch
Function	Transports air from air compressor to filter/regulator	Transports product from AutoPump to discharge point	Transports air from filter/regulator to AutoPump	Exhausts air from AutoPump
Fittings	Hose barb and clamp or one-way quick-connect fitting	Hose barb and clamp or straight through quick-connects	Hose barb and clamp or one-way quick-connect fitting	Hose barb and clamp or straight through quick-connects

* Nylon tubing is available in single tube or jacketed bundles. Contact QED for the sizes and bundle configurations.

If optional quick-connects are used, the flow of air and fluid in the hoses runs *into* the male plug and *out* of the female socket.

The quick-connect fittings on one type of hose will usually not interchange with those of another, so it is very difficult to connect a hose to an incorrect fitting.

Note:
The down well hose fittings normally have locking quick-connects. On sites with water depths over 50 feet, special consideration may be required to support the hoses. Consult with *QED* regarding such applications.

Pump Cycle Counter

Refer to Appendix F – Pump Cycle Counter

Volumes Pumped Per Cycle

- The volume of fluid pumped per cycle from an AutoPump varies depending upon the inlet air pressure, the fluid inlet head and the force against which the pump must move the fluid. This force is a sum of the static head and dynamic losses incurred during fluid movement, usually referred to as Total Head.
- The Total Head depends upon back pressure in the surface lines, hose size, fittings, vertical and horizontal pumping distance, the number of pumps feeding the hose system, air pressure to the pump, and the type of pump.
- The effects of some of these variables may cause the volume pumped per cycle to vary from pump to pump on a single site.

Pump	Volume per Cycle: Range	Volume per Cycle: Typical
Long AP4	0.58 - 0.78 gal (2.2 - 3.0 L)	0.65 gal (2.46 L)
Short AP4	0.22 - 0.36 gal (0.87 - 1.36 L)	0.25 gal (0.95 L)
Low Drawdown AP4	0.11- 0.16 gal (0.42 - 0.61 L)	0.13 gal (0.51 L)

All figures above are dependent on site specific conditions under which the pump is operating

Pump Support System

To safely support the AP-4, a pump support system is offered. Included in the system are a well cap, support rope, and quick-link assembly.
(See Figure 13 on page 36, and Figure 14 on page 37)

Well caps with various fitting combinations are available.
(See Figure 12 on page 34)

Caution:
Although it may be possible to support the pump using only tubing, it is not always wise to do so. If a pump becomes jammed in a well, a strong rope or wire rope separate from the tubing may be needed to withstand the force required to free it. Thus a separate support line is recommended.

Chapter 4: Assembly & Installation

WARNING:
PVC pipe is generally not recommended for compressed air service.

Cautions

The following suggestions are offered to reduce the complications involved in assembly and installation.

- Cover the hose ends with tape if they are being pulled through trenches. Be sure the ends of the hoses that connect to the air compressor and fluid discharge have the correct fitting leading out of the well. If you are unsure, look at the respective fittings on the pump.
- Blow out all water and particles from compressed air conduits (trunk lines, sensor hoses, air supply hoses etc.) and fluid lines for at least 10 seconds after the water and particles exit before connecting them to the system.
- When running hoses in conduit, include a rope to pull additional hoses in case they are needed at a later date
- If solid metal piping is used for compressed air conduit, it is advised that an air filter or a "Y" strainer with a fine mesh screen (60 mesh or finer) be placed at the downstream end of the piping. Metal flakes, rust, galvanizing material, dirt, etc. can be dislodged from such metal piping and travel to the pump.

Compressed Air Supply

The AP-4 System includes a compressor-to-pump air line quick disconnect fitting for the compressor.

There is a distinct air inlet on the AP-4; an "I" is stamped next to it on the head of the pump. The air inlet quick connect fitting on the pump has a female counterpart on the air inlet hose. The air inlet must be connected for the AP-4 System to function. Do not lubricate the compressed air coming out of the compressor. The AP-4 does not require lubrication and excess oil may foul the filter/regulator.

WARNING:
The compressor should not provide more pressure than the filter can accept. The filter and regulator with plastic bowl accepts a maximum of 150 psi air pressure. The metal bowl can accept 250 psi. Maximum output air pressure setting on the standard regulator is 120 psi. A higher pressure regulator and gauge are optional.

Component Assembly

Quick-Connects/Hose Barbs

Follow the instructions on **Figure 7** for properly securing the locking quick-connects. See **Figure 8 and Figure 9** for properly securing hose barbs.

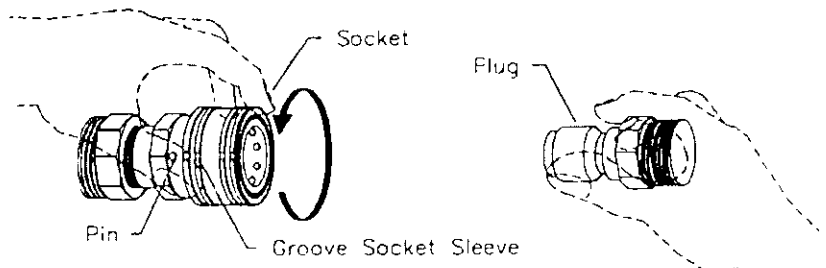
AutoPump Assembly

STEP 1 - **Attach Fluid Discharge Hose (black)**

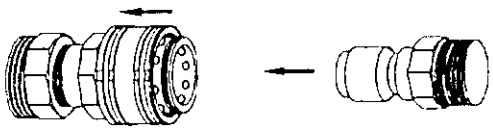
Note:
If a well cap with holes is used, insert the hoses through the cap before attaching hose.

a. Attach the fluid discharge hose or tubing to the AutoPump. **(See Figure 10 and Figure 11)**

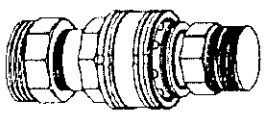
b. Attach the other end of the discharge hose to the fluid discharge point.



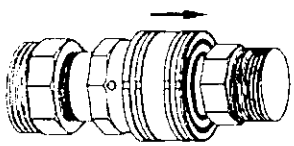
a. Rotate socket sleeve until groove is aligned with the pin close to the hex.



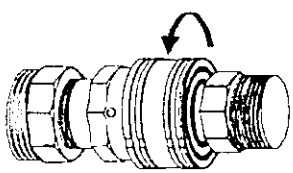
b. Pull socket sleeve against the hex (the pin will be totaly covered). Hold in this position for plug insertion.



c. Push plug into socket until the plug is almost covered.



d. Let the socket sleeve go in. It must slide all the way until the pin is visible again.



e. Rotcte the socket sleeve so the groove does not align with the pin. To test, gently pull hexes of both fittings in opposite directions. Fittings must remain attached.

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Figure 7 - Locking Quick-Connects

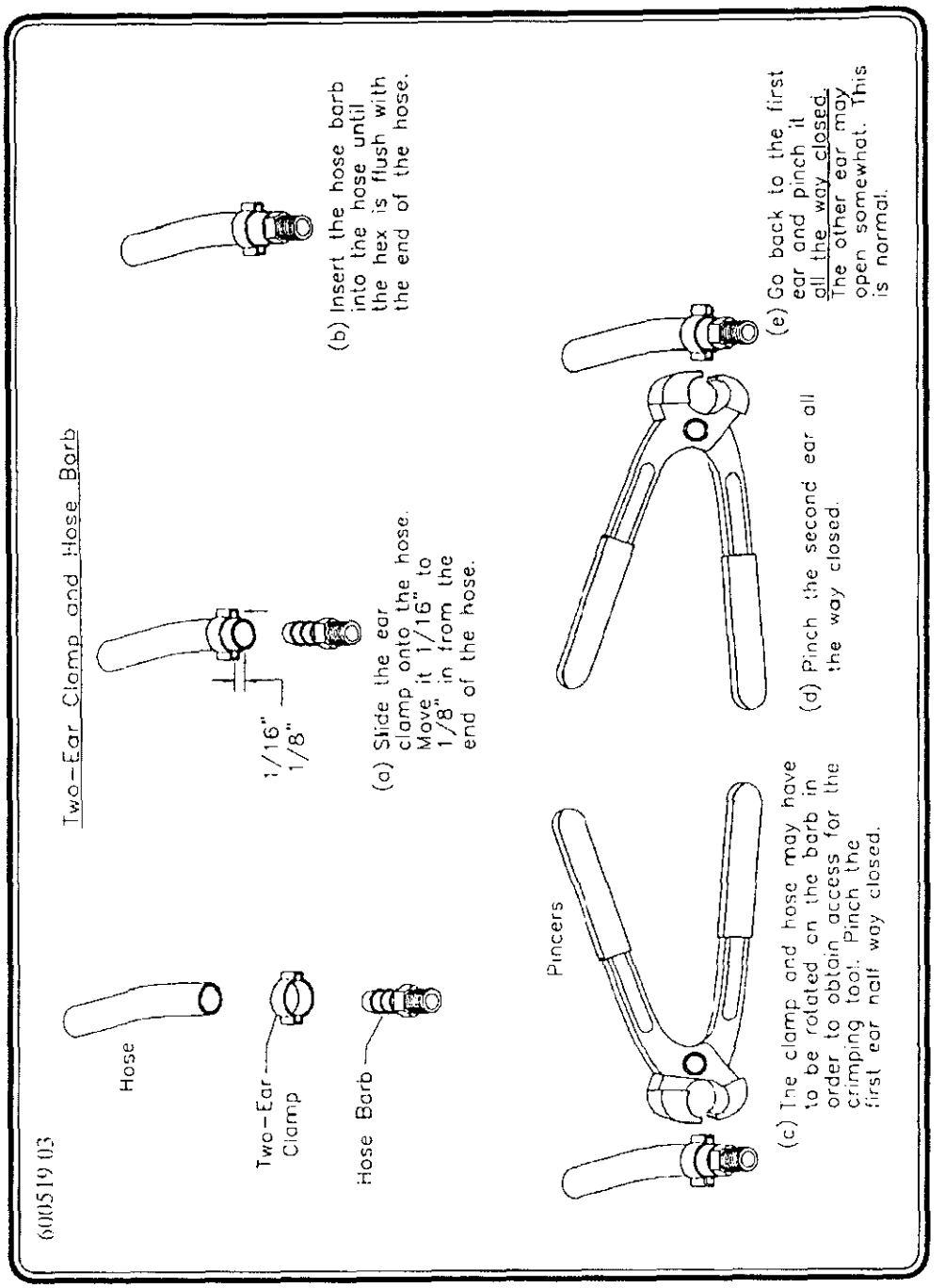


Figure 8 - Two-Ear Clamp and Hose Barb Assembly Instructions

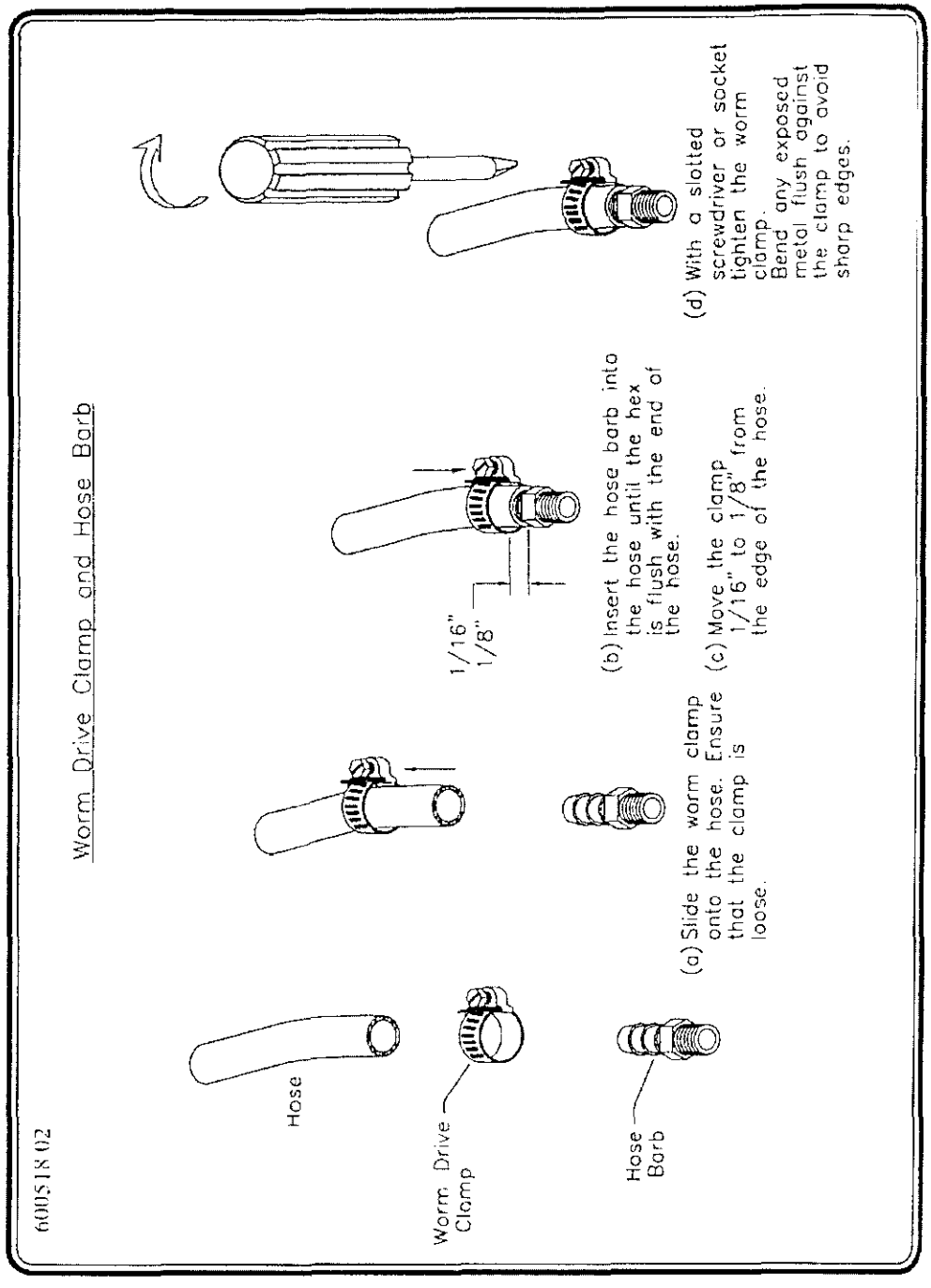


Figure 9 - Worm Drive Clamp and Hose Barb Assembly Instructions

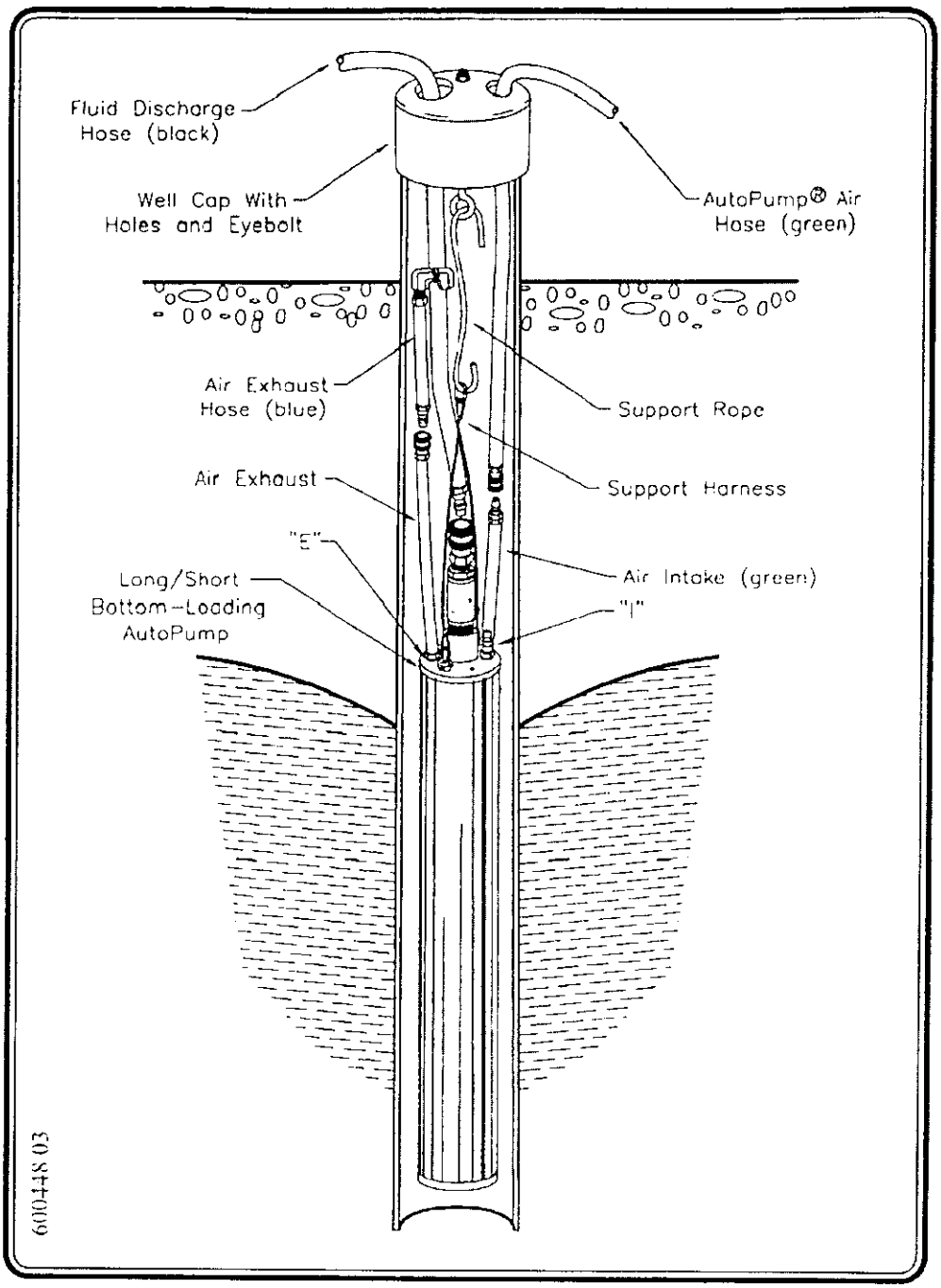


Figure 10 - AP-4 Assembly with Quick-Connects: Well Cap with Holes

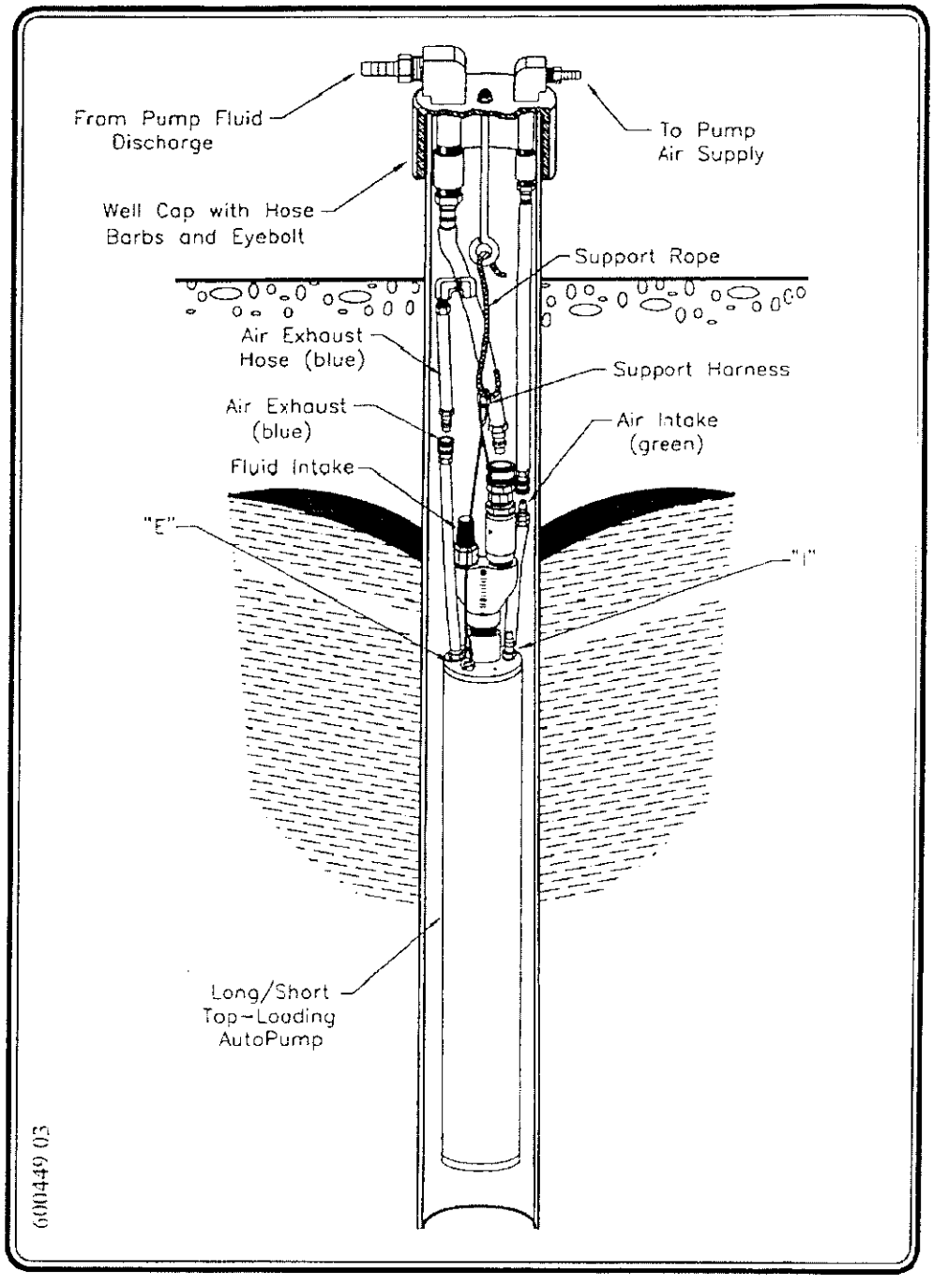


Figure 11 - AP-4 Assembly: Well Cap with Hose Barbs

STEP 2 - Attach AutoPump Air Hose (green)

a. If a Pump Cycle Counter (PCC) is used, install it downstream of the air filter regulator and as close to the pump as is reasonable.

b. Attach the AutoPump air hose to the single stage filter/regulator or optional Pump Cycle Counter **(See Figure 2 on page 11)**

c. Attach the other end of the AutoPump air hose to the AutoPump.

STEP 3 - Attach Air Exhaust Hose (blue)

a. Attach the air exhaust hose to the AutoPump. **(See Figure 10 and Figure 11)**

STEP 4 - Attach System Air Supply Hose (blue)

a. Thread the air hose socket with 1/4-inch MPT to the compressor. Use Teflon tape or sealant on the threads.

b. Attach the air hose plug end of the system air supply hose to the socket now attached to the compressor.

c. Attach the socket on the discharge end of the hose to the single stage filter/regulator. **(See Figure 2 on page 11)**

The pump will work in a well that is under vacuum, but there are several conditions that must be considered. **(See Appendix D)**

Dry Test

Before installing the AutoPump in the recovery well, it is important to test the system for proper operation. Before beginning this test, make sure that all hoses are properly connected as described in the previous section.

To test for float movement and air valve actuation follow these steps:

STEP 1 - Drain all fluid from the pump through the bottom inlet check valve (Bottom-loading) or air inlet fitting (Top-loading).

STEP 2 - Hold the pump horizontally.

STEP 3 - Tip the top of the pump downwards to about 45°. The float should slide to the top of the pump and open the air valve. Air should be heard going into the pump. It will exit the inlet fluid check valve (Bottom-loading) or the outlet check valve (Top-loading).

Caution:
If air is not acceptable in the fluid discharge hose, disconnect the hose before performing this test.

STEP 4 - Tip the head of the pump upwards past horizontal to 45° from the vertical. The float should slide to the bottom of the pump and close the air valve.

STEP 5 - Repeat this process 3 or 4 times to ensure the float moves freely and the air-valve opens and closes. If the pump must be tilted nearly vertical before the float slide or the air valve moves, open the pump and inspect for interference.

Pump Support System and Hose Bundling Assembly

A pump support system can be created to support the pump and hoses. The pump support system uses well caps with various fitting combinations. **(See Figure 12)**

Though it is possible in some instances to support a downwell pump with only the tubing, a separate support line is recommended.

Note:
The walls of some wells deform over time. They may trap a downwell pump. In some of those cases the AP-4 support harness and strong support line have proven useful when retrieving the pump.

In addition to supporting the down-well equipment with a support rope, it may be important to support down-well hoses (in most cases nylon tubing does not need to be supported by the support line). Since the down-well hoses can weigh more than the pump, particularly in wells over 50 feet deep with fluid inside the discharge hose, hose support can avoid problems such as kinking, jamming, and breaking.

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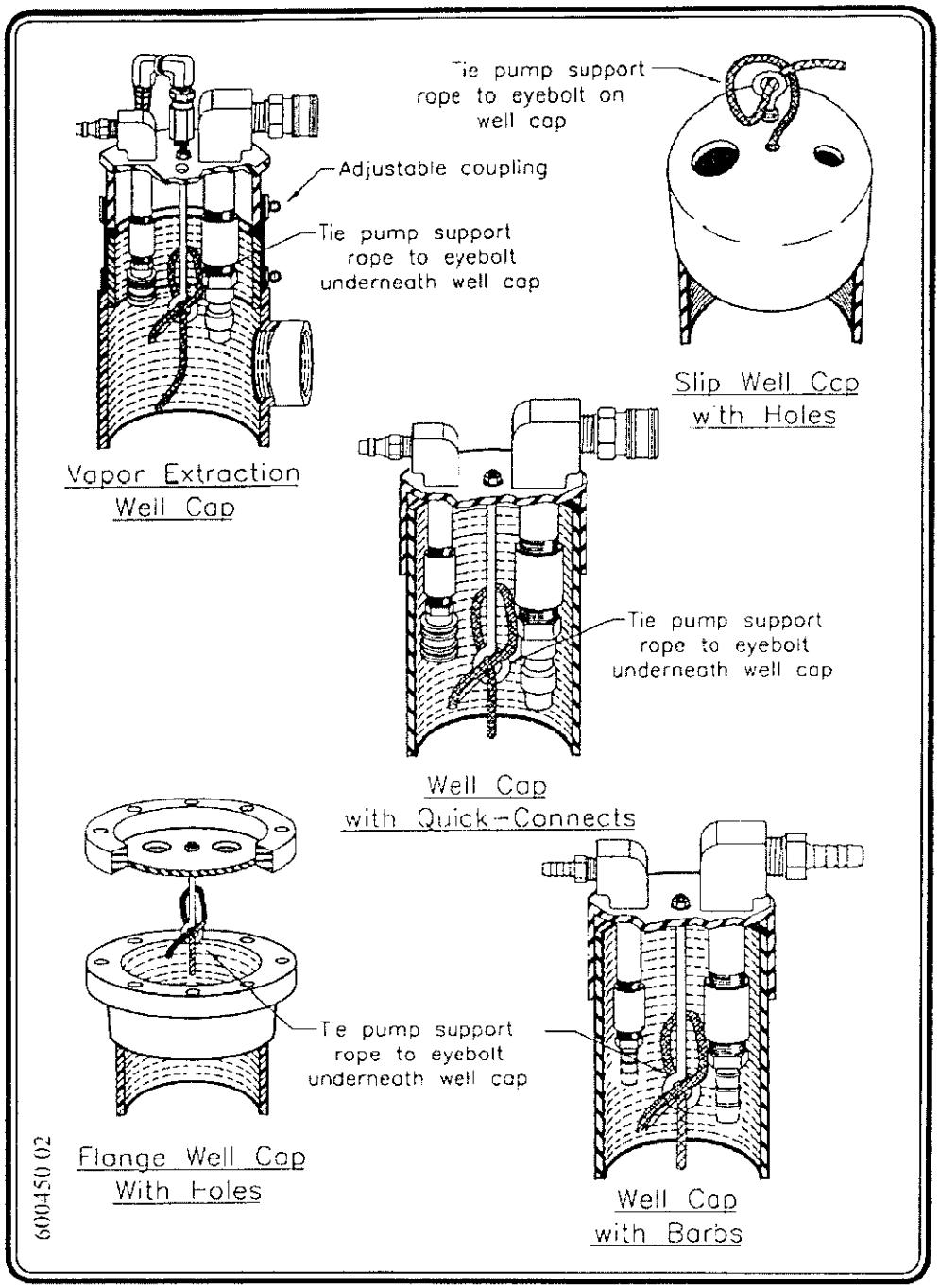


Figure 12 - Examples of Well Caps

Hose bundling or the use of jacketed tubing reduces equipment entanglement at the well surface, and aids the removal of the pump from the well. Bundling also assists in positioning the pump and down-well hose assembly against one side of the well casing. Maximum space is created for other items, such as probes, to be periodically placed inside the well.

Follow these instructions to create a hose bundle.

STEP 1 - Lay the equipment on the ground and make all of the necessary hose connections. **(See Component Assembly on page 26 and 32)**

STEP 2 - If a well cap is supplied, install it on the hoses. **(See Figure 10** for well cap with holes; **see Figure 11** for well cap with hose barbs)

STEP 3 - Connect the quick-link assembly on the support rope to the eyebolt on the AP-4 and lay the support rope out along with the hoses. Make sure that none of the hoses or support ropes are crossing over each other. **(See Figure 13)**

Note:
To make the next step easier, pull the support rope and the hoses taut.

STEP 4 - Starting at the AutoPump end of the hose, put a tie-wrap through the center of the braided support rope just above the uppermost quick-connect or barb on the AutoPump. **(See Figure 13 and Figure 14)**

STEP 5 - Pulling the rope taut, put the tie-wrap around the fluid discharge hose with the rough surface outwards. Cross the ends and complete the figure-8 pattern by securing the ends around the exhaust hose. When you connect the tie-wrap make sure it is straight and is not kinking the hoses. **(See Figure 13 and Figure 14)**

Note:
After completing this step, the fluid discharge hose will be attached to the support rope and the exhaust hose. At this point the air supply hose is still lying free.

STEP 6 - Place the next tie-wrap two feet towards the well cap from the first. Secure the air supply hose rather than the exhaust hose.

Note:
It is important to put the tie-wraps approximately two feet apart to keep a proper discharge hose/support rope bundle. Experience has shown that spreading the tie-wraps further apart than two feet increases the probability for hose kinking.

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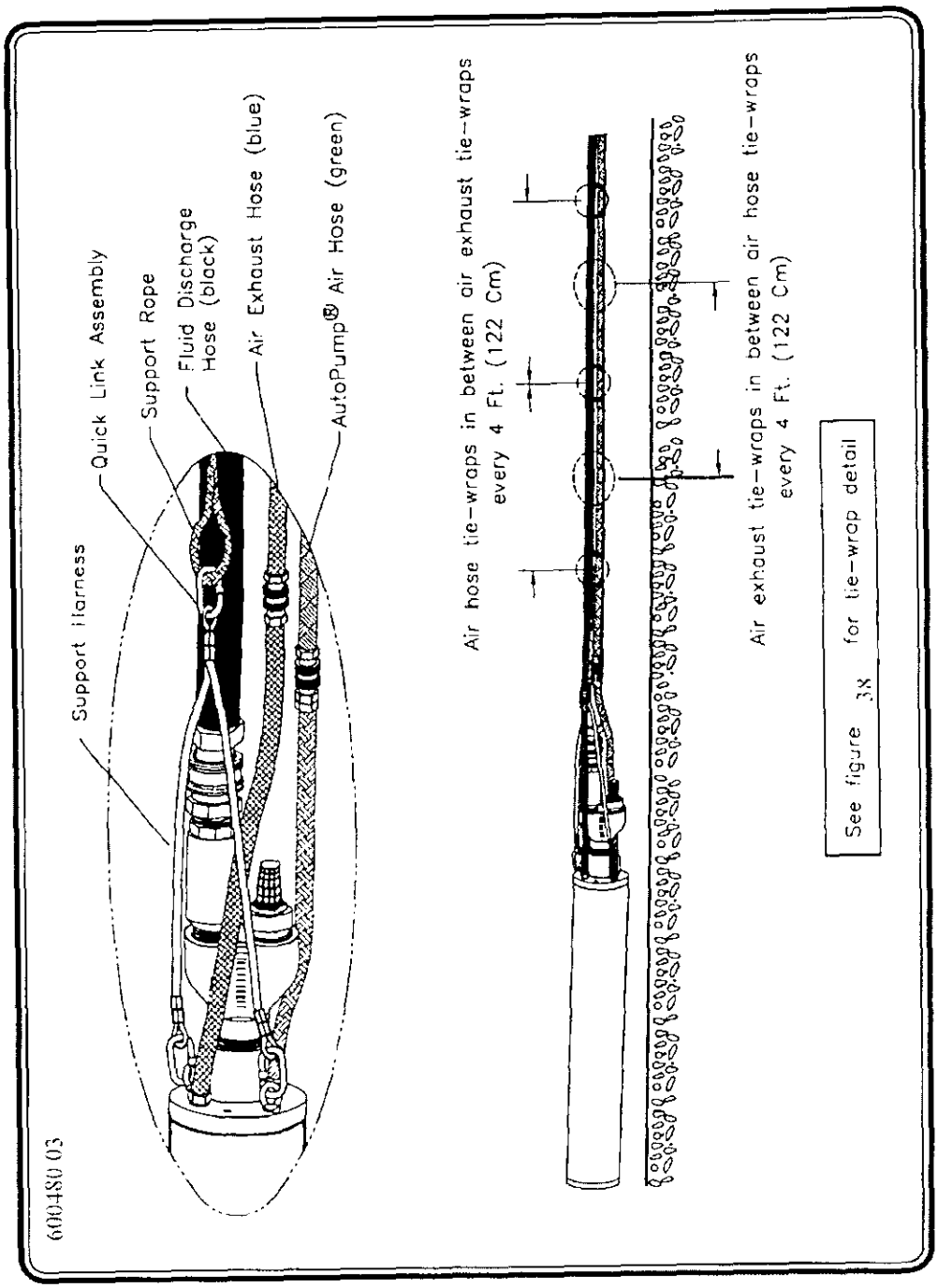


Figure 13 - Hose Bundling: Part 1 of 2

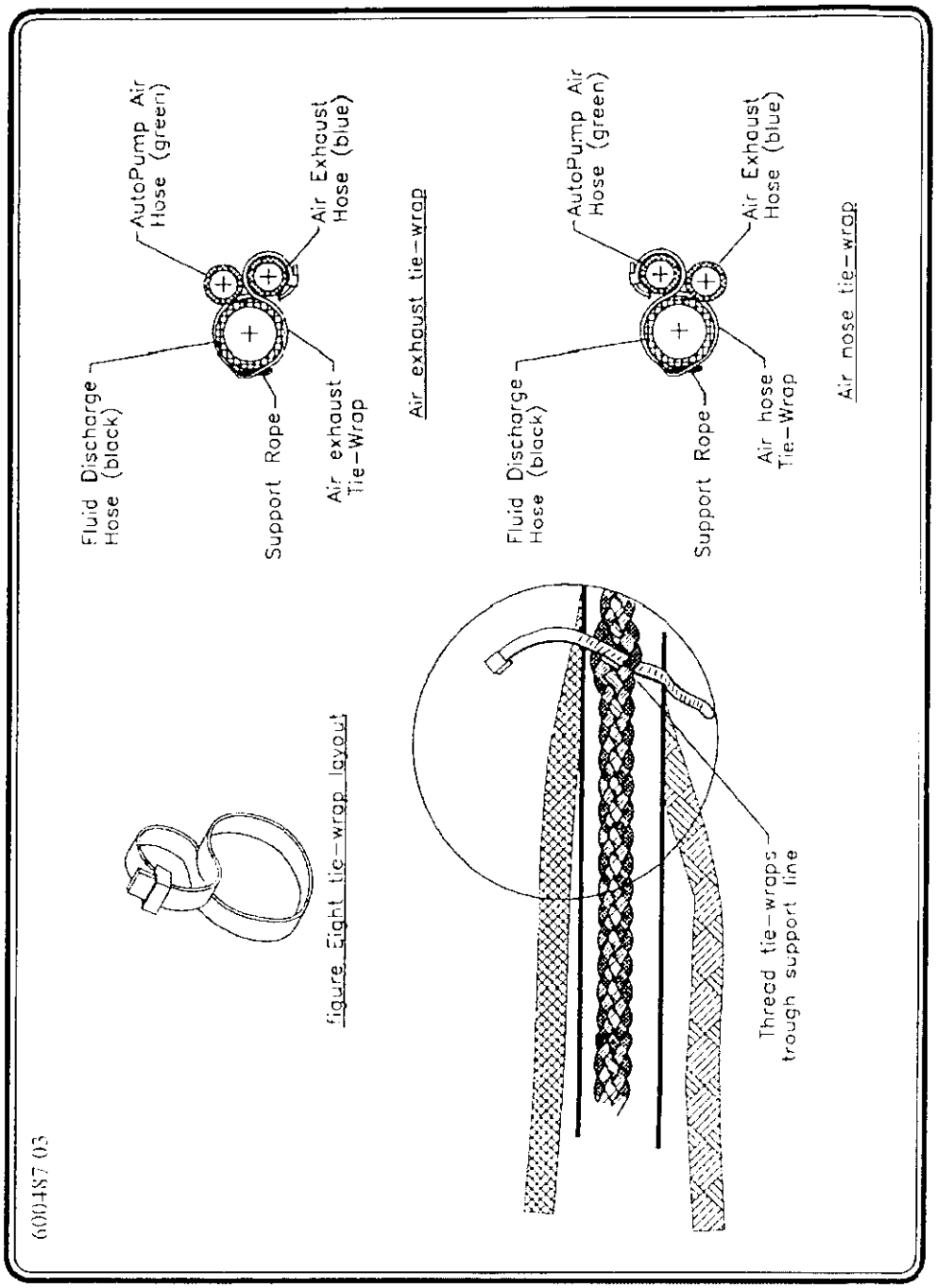


Figure 14 - Hose Bundling: Part 2 of 2

STEP 7- Continue to alternate the air exhaust and the air supply tie-wraps every two feet, stopping about five feet from the wellhead.

STEP 8- Being careful not to leave any sharp edges, cut the excess from the tie-wraps.

You now have a down-well bundled hose assembly that supports both the hoses and the down-well equipment.

AutoPump Installation

Once the installation of the pump support system is completed, you may install the AutoPump in the recovery well.

STEP 1 - Lower the pump until it is at the desired level.

STEP 2 - Secure the pump by tying off (securing) the support line or by placing the well cap on the well.

STEP 3 - Increase the air pressure to the pump until the pump is pushing the fluid out at the desired rate. With sufficient air pressure (at least 10 to 15 psi over the vertical static head), the AutoPump will gradually draw down the fluid level in the well to the level of the pump. The time required for this draw down varies with the yield of the well as compared to the flow rate of the pump. The maximum recommended continuous operating pressure is 120 psi (200 psi for high pressure version).

The pump rate can be increased slightly by increasing the air pressure to the pump. However, under conditions with high inlet pressures and little discharge resistance, some air may exit with the fluid. That would be due to a brief residual pressure in the pump which discharges fluid (and air) even after the exhaust valve is opened.

Under normal operating conditions, no air should exit the pump with the fluid.

If the pump is moving air out the fluid discharge and this is undesirable, a needle valve in the air line can be used. This reduces the air flow rate to the pump and thus the pressure buildup in the pump. Alternately, reduce the pressure going to the pump though the pressure regulator.

Note:
Submerging the pump before supplying it with air will result in fluids entering the exhaust hose. Those fluids will be discharged from the exhaust hose during the first few cycles of the pump. If such discharge will not be confined to the well, the operator may wish to install the pump with a low air pressure supplied to the pump. To obtain the value of that low pressure in psi, multiply the number of feet that the pump is to be submerged by one-half (0.5).

WARNING:
Be sure that the fluid discharge has a closed valve during such a process because the pump may have enough pressure to begin pumping fluid from the well.

Chapter 5: Start Up and Operation

Start Up Checklist

In normal operation, the AP-4 System requires little attention.

Before regulating the air pressure to the desired operating pressure, ensure that the following conditions exist:

1. Personal Protective Equipment (PPE) is being used by all personnel.

2. The pump is submerged below the fluid level.

3. All hoses are connected.

4. The exterior air filter is mounted vertically to allow the filter and its bowl drain to operate properly.

5. All out-of-well air and fluid valves are in their correct positions.

6. A method of rapid disconnect and exhaust (or at least a shut off) of compressed air to the pump is available in case of an unexpected occurrence.

7. When pumping is to begin, either gradually raise the air pressure to the pump or gradually open the air valve to the pump to allow the pump and hoses to slowly pressurize. Check for leaks as you do this.

8. As the air pressure overcomes the static and dynamic resistant forces, the pump will begin to cycle. Listen for the periodic exhaust of air from the pump to determine that the pump is working. The pump should push fluid out and then exhaust sharply to fill before pressurizing and pushing the fluid out again.

   Cycling can also be monitored by placing an air pressure gauge at the well head and by observing a pulse counter, if one is present.

Adjusting the Pump Cycle Counter

Refer to Appendix F – Pump Cycle Counter

Observation of System Operation

Observe the system operation for at least 10 pump cycles to ensure everything is working. If the well influx is low so the pump seldom cycles, pour clean water into the well to check on the pump. If allowed, the pump discharge can be directed into the well so the pump will cycle within an acceptable period to allow for observance of operation. Check your local regulations to determine if these practices are permissible.

> **Note:**
> The Pump Cycle Counter may have to be readjusted if it is set when the water is recirculating to the well.

After the entire site is operating, return to each well to ensure that the pump and PCC's are functioning properly. The addition of other pumps and possible system back pressure can necessitate air pressure and counter readjustment.

Downwell Testing of the AutoPump

While the AutoPump is in the well, it can be tested by putting compressed air into the exhaust hose of the pump.

> **Note:**
> The air supply hose must be shut off or pressurized when this is done.

The compressed air will enter the pump through the exhaust valve and push any fluids in the pump up the discharge tube. If sufficient compressed air is continually supplied, it will also exit the discharge tube and cause the fluid in the discharge hose to be airlifted to the surface. This method can be used to lighten the pump and hoses before removing the pump from the well. This process can also show whether the fluid inlet check valve is sealing and if the pump is capable of discharging fluid.

AutoPump Shutdown while Submerged

The AutoPump can be submerged for long periods of time at most sites. If the well environment is such that deposition occurs on stainless steel parts, the operator may wish to raise the pump above the water level during a shutdown of the system.

000268

AutoPump Removal Technique (optional)

By pressurizing the exhaust hose as noted above and airlifting the fluids out of the well, the fluid in an AutoPump and discharge hose can be reduced significantly. This can be used to lighten the system before removing it from the well.

Chapter 6: Maintenance

General Maintenance

The AP-4 should be relatively free of maintenance. The frequency of maintenance depends upon the nature of the fluids being pumped. Follow these general maintenance checks.

- Periodically inspect all hoses and connections for damage. Make sure that the hoses are not split or cracked, and listen for leaks in the system.
- Even if significant amounts of oil and water enters the air hose, the AP-4 System should perform reliably for years. Check the Air filters and filter bowl drains on the filters/ regulator for saturation and operation every few weeks.
- Periodically drain the air filters on the air hose to the pumps of collected particles, water and oil. Draining prevents the filter from clogging up or being otherwise damaged. Check the regulator to ensure the pressure setting has not drifted appreciably.
- An automatic drain on the compressor is highly recommended, since such an addition can dramatically increase air filter life and decrease maintenance. Automatic drains are available from QED.
- The pump can be opened up in the field if the area is clean and dry.

A maintenance video is available from QED.

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Maintenance Table

A visual check and/or maintenance is recommended at least once every two weeks, but some site environments may demand more frequent service. The following table outlines the recommended minimum schedule for the AP-4 System.

Equipment	Biweekly	Monthly*	As Required
Air Quality Check • Single Stage Filter/Regulator	X		
AutoPump Service			X
Check Pump Cycle Counter	X		
Check Volume Pumped Per Cycle		X	

* Site conditions may require maintenance more often.

The following sections describe each maintenance activity in detail.

Air Quality Check

Single Stage Filter/Regulator Maintenance

Even using air which has some oil and water in it, the AutoPump System should operate trouble-free for years. The air filter is normally a 5 micron filter with a replaceable element.

To replace the element in the air filter on the single stage filter/regulator use the following procedure:

STEP 1 - **Disconnect Air Source**

- Valve off the air supply and drain the downstream air to the air filter. Or disconnect the blue system air supply hose from the single stage filter/regulator. The air filters will depressurize, allowing them to be safely serviced.

WARNING:
Do not remove a filter bowl that is pressurized.

STEP 2 - Remove Filter Bowl

- Different styles of air filters are available. The following instructions are given for the most typical filter used.

- Remove the bowl of the air filter by sliding the black button downward and twisting the bowl about 1/10 of a turn. The bowl should slide downward from the upper portion of the filter revealing the filter element. Unscrew the element as you would unscrew a light bulb. Hand tighten the element after replacing it.

  Make sure to replace the correct element.

  - The **5 micron particulate filter** was reddish-brown up until 1994.

  - The new elements are white.
    Filter (for the FR 60 Filter Regulator): *QED* Part No. 205071

STEP 3 - Bowl Drain

Optional Float Drain

- Wash out any deposits and oil buildup from the filter bowl with warm water and soap. To make sure the float drain is operating freely, shake it: the drain should rattle. Test the float drain by filling the bowl with water, assembling the bowl to the filter and reconnecting it to the air supply. The water should drain from the bowl. When under pressure, the drain should not leak.

Standard Manual Drain

- With water in the bowl, open the drain and ensure the liquid drains easily. When under pressure and closed, the drain should not leak.

AutoPump Service

AutoPump Shutdown and Removal from Well

To shut down and remove the AutoPump, follow these directions:

STEP 1 - Wait until the pump is in its discharge cycle and then raise it above the water level in the well. This will empty most of the fluid from the pump making it lighter to lift. There will also be less fluid to drain from the pump.

Note:
See Start Up and Operation for optional pump removal technique.

STEP 2 - Pull the pump and hoses to the surface.

STEP 3 - Shut off the air to the pump and disconnect the air hose from the pump.

STEP 4 - Ensure that there is a safe place to drain any fluid from the pump and discharge hose.

STEP 5 - Disconnect the fluid discharge hose from the pump.

For Bottom-loading pumps

Drain the fluid in the pump by lifting the bottom inlet check valve from its seat by using a thin wire or Allen wrench.

For Top-loading pumps

Drain the fluid by turning the pump upside-down and allowing fluid to flow from the air inlet fitting.

Caution:
Wear gloves and catch the draining fluid in a sump or bucket.

Removing Pump Casing

Follow these instructions for removing the pump casing:

Caution:
When assembling or disassembling the pump, do not rotate the casing. This action may cause the float and control rod to rotate with the casing. Instead of rotating the casing, spin the bottom check valve (or plug on a Top-Loading pump) and hold the casing stationary.

Caution:
After troubleshooting is completed and before assembling the pump, slowly move the float through its range to ensure that the lever will trip, even if the pump fills and empties slowly.

Unscrew the bottom check valve or plug from the discharge tube. **(See Figure 15)**

STEP 1 - Fit a spanner wrench in one of the holes in the circumference of the lower head. The lower head has right-handed threads, so the direction of rotation for disassembly is counterclockwise if looking at the bottom of the pump.

STEP 2 - Hold the top head of the pump by the support rings.

STEP 3 - Insert a large screw driver through one of the support rings and leverage it against the coupling for the discharge tube.

Caution:
Do not press against the air hoses or air hose fittings.

STEP 4 - Turn the plug or check valve.

Caution:
Do not leverage the large screwdriver against the air inlet or air exhaust fittings. This could damage the fittings.

Note:
The O-rings at the top and bottom of the pump may have swollen due to solvents in the fluid being pumped and therefore make turning the plug or check valve difficult.

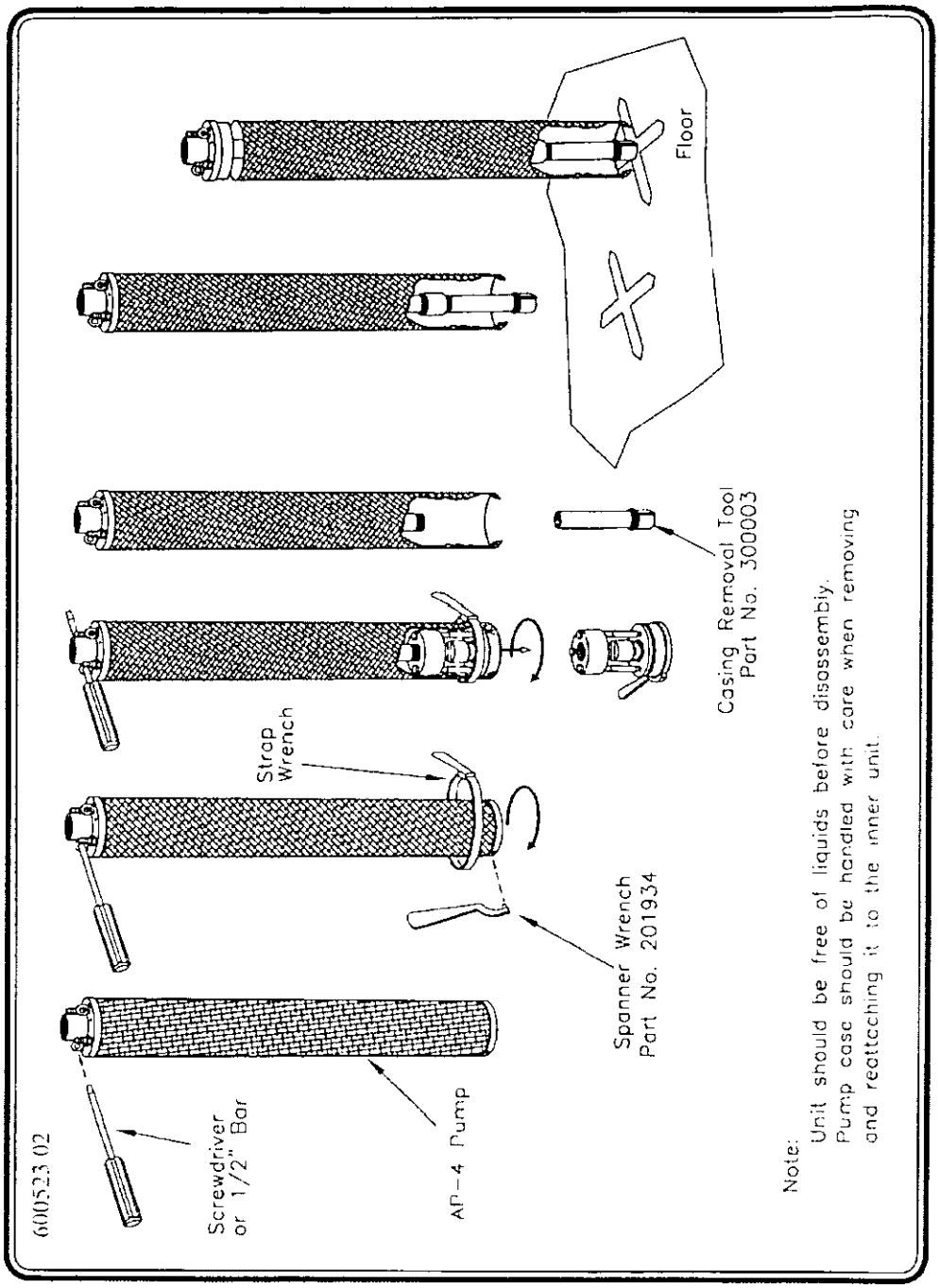


Figure 15 - Removing AP-4 Pump Casing

STEP 5 - If you suspect the pump of being clogged with mud or other particles, prevent the outer casing from turning while the lower plug or check valve is unscrewed.

STEP 6 - Have a second person hold a strap wrench around the pump casing. If there is only one person, hold the upper head in a vise while unscrewing the lower head. This allows a free hand to hold the strap wrench which prevents the pump casing from rotating.

STEP 7 - When the plug or check valve is removed, use a pump casing removal tool to remove the pump casing. The pump casing removal tool is a specially threaded coupling with a pipe extension.

STEP 8 - Thread the coupling onto the bottom of the discharge pipe (onto the same threads from which the lower head was unscrewed).

STEP 9 - Hold the pump vertically upright with the pump casing removal tool extending down out of the pump casing.

STEP 10 - Hold the pump casing and striking the pump casing removal tool on the ground. This will cause the pump casing to slide off the upper O-ring and will allow it to slide off the pump.

Cleaning Pump Interior

The inner workings of the pump should now be exposed for inspection and cleaning. **(See Figure 16, Figure 17, Figure 18, Figure 19, Figure 20, and Figure 21)**

Note:
A Scotch Brite® abrasive pad is useful for cleaning debris from the pump components.

STEP 1 - Gently brush off built-up solids from the float, the discharge tube, the pump casing and the control rod guide.

STEP 2 - The pump can be steam cleaned without damage.

STEP 3 - Remove thick deposits of hardened scale on the discharge tube by using a handbrush or by lightly tapping the discharge tube with a small hammer. Be careful not to strike any pins or other components, since they may be damaged.

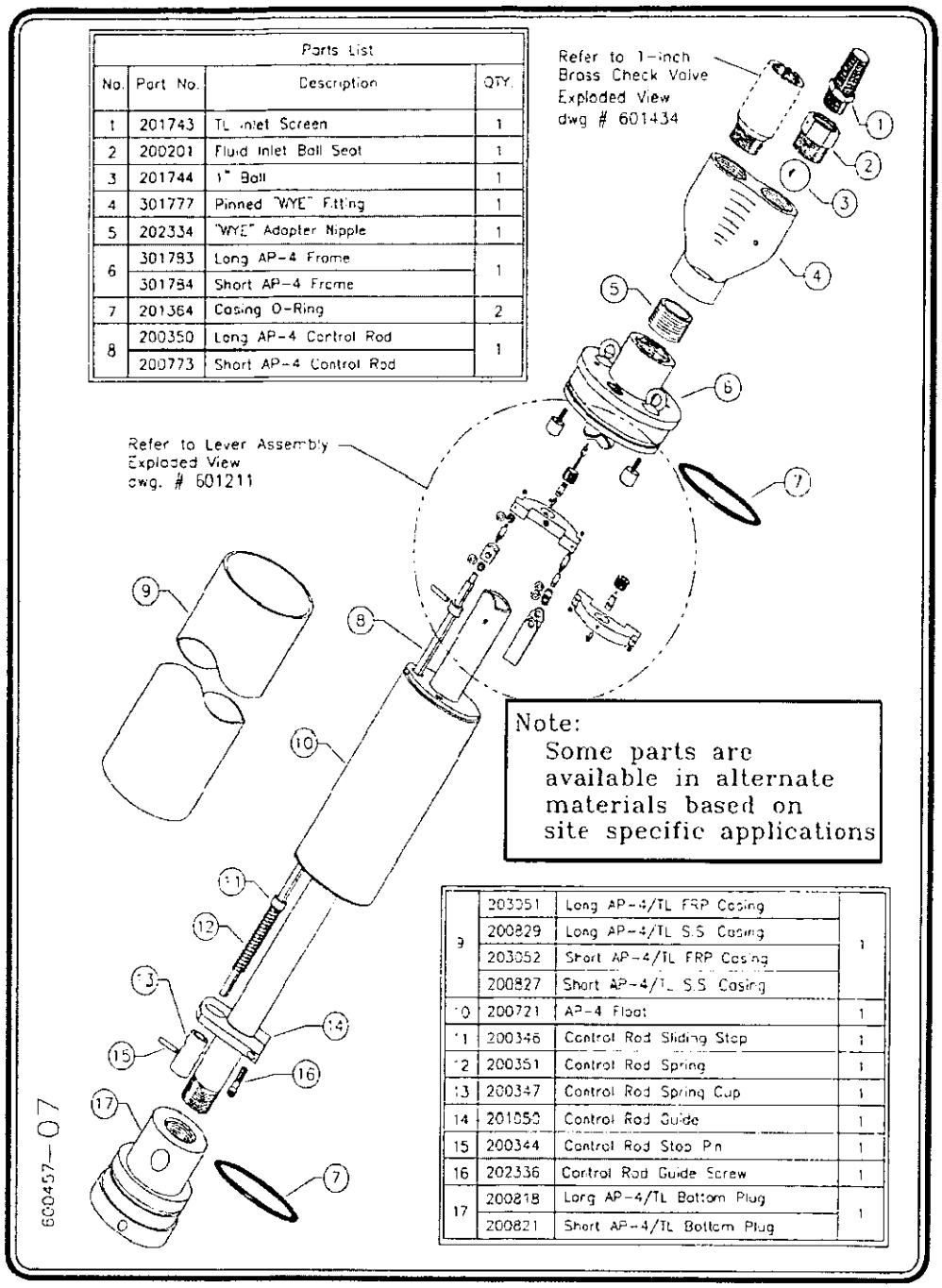
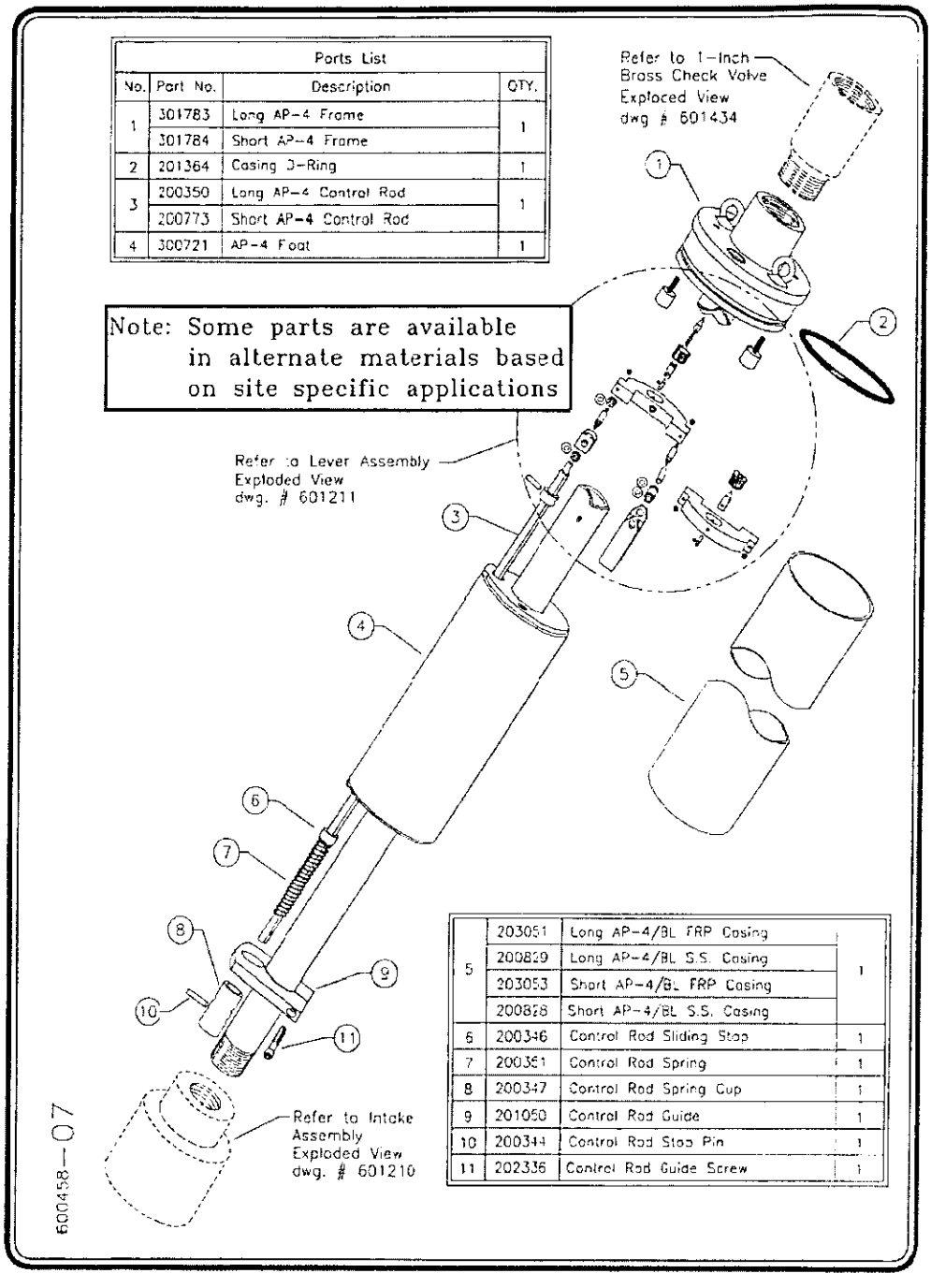


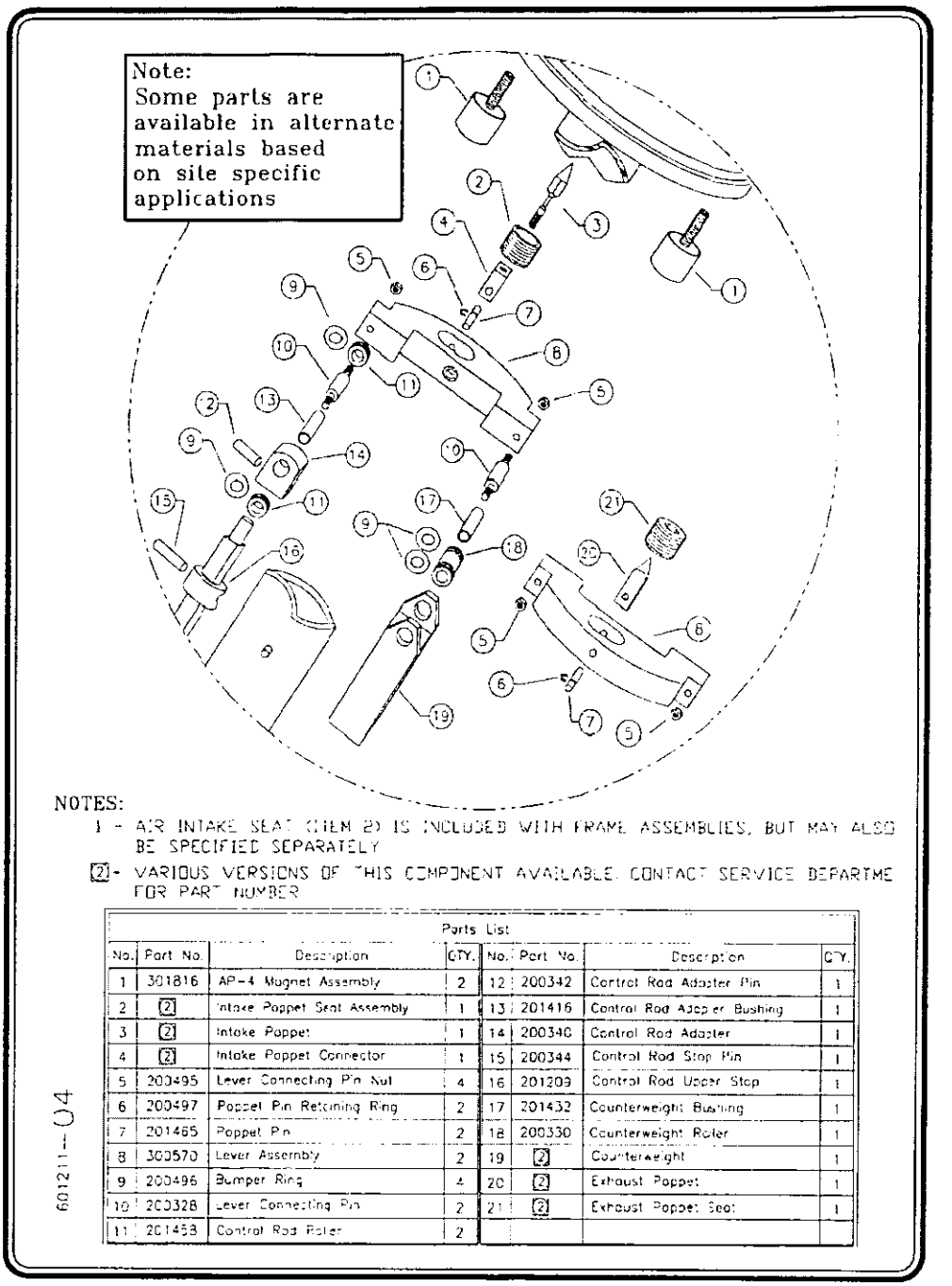
Figure 16 - Exploded View of a Top-Loading AutoPump AP-4 (Long & Short)



Ports List			
No.	Part No.	Description	QTY.
1	301783	Long AP-4 Frame	1
	301784	Short AP-4 Frame	
2	201364	Casing O-Ring	1
3	200350	Long AP-4 Control Rod	1
	200773	Short AP-4 Control Rod	
4	300721	AP-4 Foot	1

5	203051	Long AP-4/BL FRP Casing	1
	200829	Long AP-4/BL S.S. Casing	
	203053	Short AP-4/BL FRP Casing	
	200828	Short AP-4/BL S.S. Casing	
6	200346	Control Rod Sliding Stop	1
7	200351	Control Rod Spring	1
8	200347	Control Rod Spring Cup	1
9	201050	Control Rod Guide	1
10	200344	Control Rod Stop Pin	1
11	202336	Control Rod Guide Screw	1

Figure 17 - Exploded View of a Bottom-Loading AutoPump AP-4 (Long & Short)



NOTES:

1 - AIR INTAKE SEAT (ITEM 2) IS INCLUDED WITH FRAME ASSEMBLIES, BUT MAY ALSO BE SPECIFIED SEPARATELY

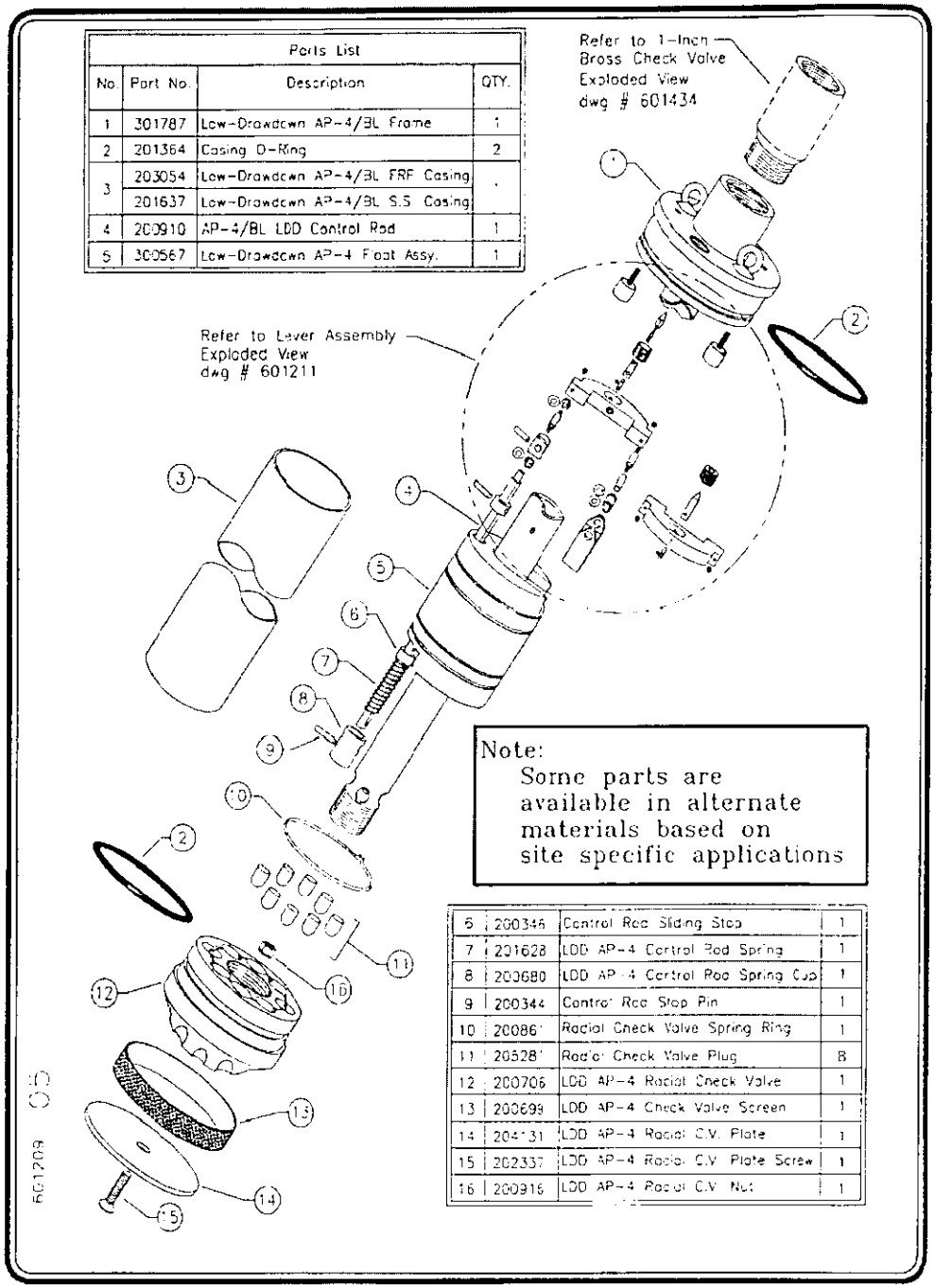
[2]- VARIOUS VERSIONS OF THIS COMPONENT AVAILABLE. CONTACT SERVICE DEPARTME FOR PART NUMBER

601211--04

Parts List

No.	Part No.	Description	QTY.	No.	Part No.	Description	QTY.
1	301816	AP-4 Magnet Assembly	2	12	200342	Control Rod Adapter Pin	1
2	[2]	Intake Poppet Seat Assembly	1	13	201416	Control Rod Adapter Bushing	1
3	[2]	Intake Poppet	1	14	200340	Control Rod Adapter	1
4	[2]	Intake Poppet Connector	1	15	200344	Control Rod Stop Pin	1
5	200495	Lever Connecting Pin Nut	4	16	201309	Control Rod Upper Stop	1
6	200497	Poppet Pin Retaining Ring	2	17	201432	Counterweight Bushing	1
7	201465	Poppet Pin	2	18	200330	Counterweight Roller	1
8	300570	Lever Assembly	2	19	[2]	Counterweight	1
9	200496	Bumper Ring	4	20	[2]	Exhaust Poppet	1
10	200328	Lever Connecting Pin	2	21	[2]	Exhaust Poppet Seat	1
11	201458	Control Rod Roller	2				

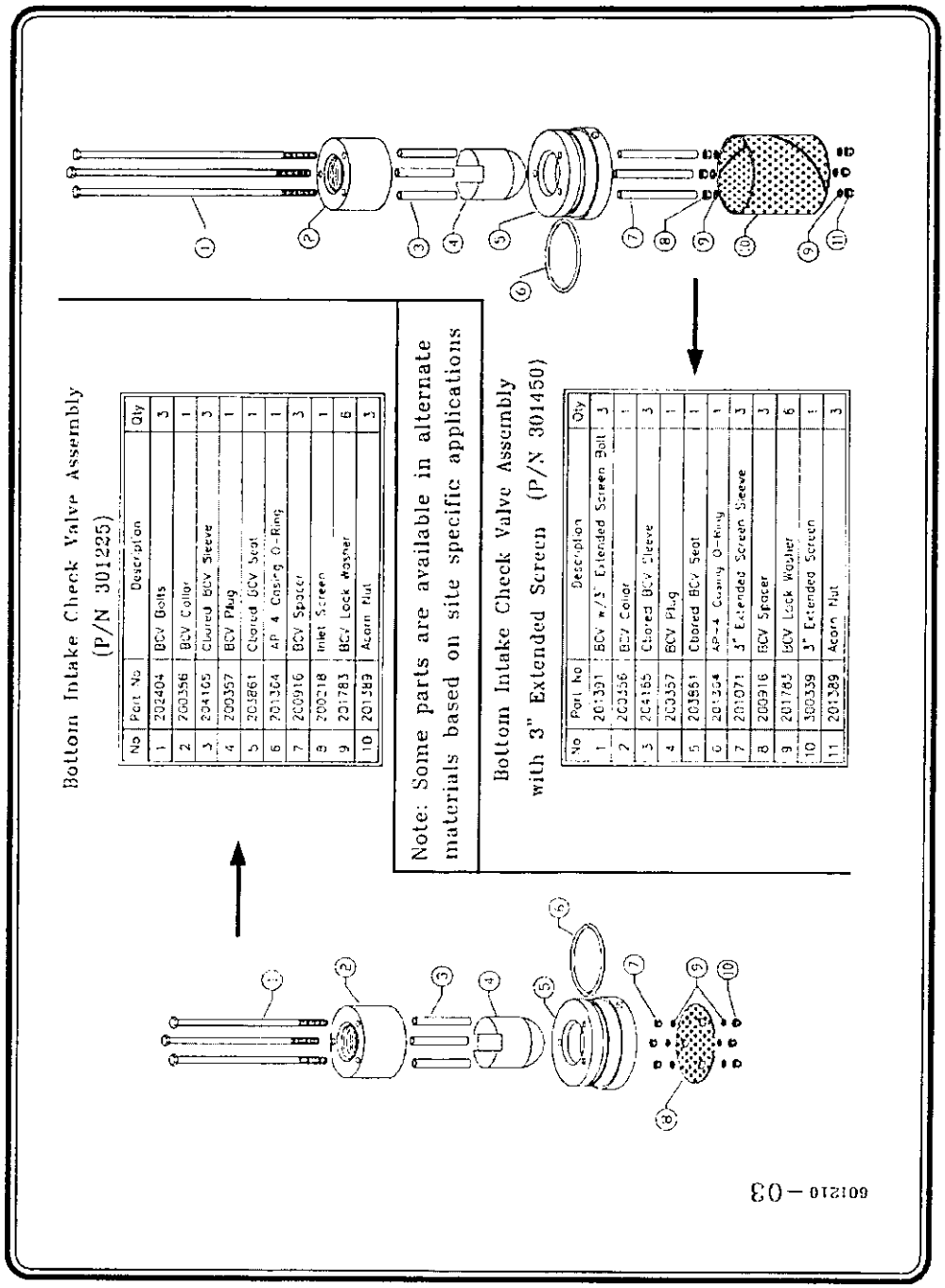
Figure 18 - Exploded View of AP-4 Lever Assembly



Parts List			
No.	Part No.	Description	QTY.
1	301787	Low-Drawdown AP-4/BL Frame	1
2	201364	Casing O-Ring	2
3	203054	Low-Drawdown AP-4/BL FRP Casing	1
	201637	Low-Drawdown AP-4/BL S.S Casing	
4	200910	AP-4/BL LDD Control Rod	1
5	300567	Low-Drawdown AP-4 Float Assy.	1

6	200346	Control Rod Sliding Stop	1
7	201628	LDD AP-4 Control Rod Spring	1
8	200680	LDD AP-4 Control Rod Spring Cap	1
9	200344	Control Rod Stop Pin	1
10	200867	Radial Check Valve Spring Ring	1
11	200328	Radial Check Valve Plug	8
12	200706	LDD AP-4 Radial Check Valve	1
13	200699	LDD AP-4 Check Valve Screen	1
14	204731	LDD AP-4 Radial C.V. Plate	1
15	202337	LDD AP-4 Radial C.V. Plate Screw	1
16	200916	LDD AP-4 Radial C.V. Nut	1

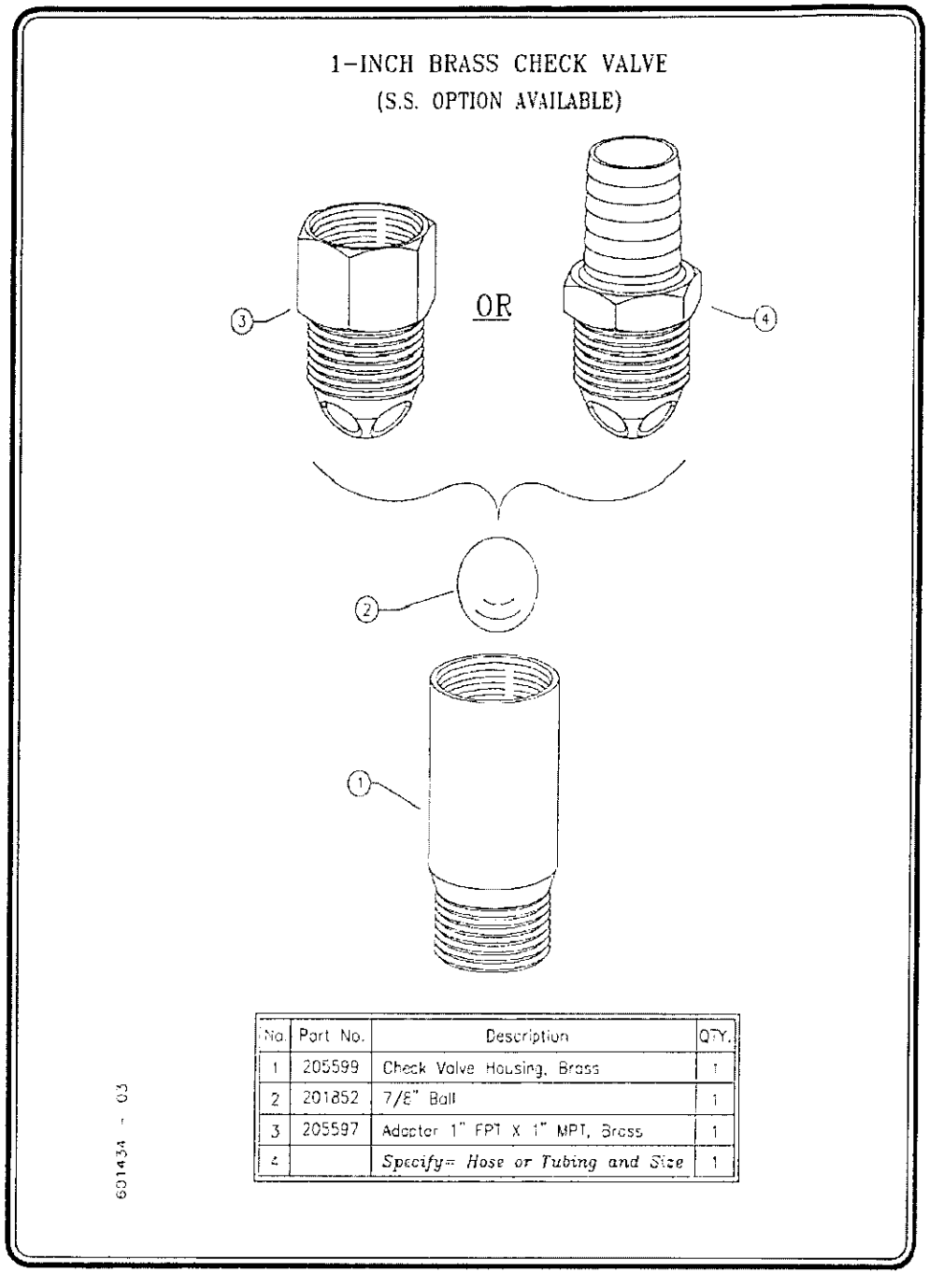
Figure 19 - Exploded View of LDD AutoPump AP-4



No	Part No	Description	Qty
1	202404	BCV Bolts	3
2	200356	BCV Collar	1
3	204165	Cloned BCV Sleeve	3
4	200357	BCV Plug	1
5	203861	Cloned BCV Seat	1
6	201364	AP-4 Casing O-Ring	1
7	200916	BCV Spacer	3
8	200218	Inlet Screen	1
9	201783	BCV Lock Washer	6
10	201389	Acorn Nut	3

No	Part No	Description	Qty
1	201391	BCV w/3" Extended Screen Bolt	3
2	200356	BCV Collar	1
3	204165	Cloned BCV Sleeve	3
4	200357	BCV Plug	1
5	203861	Cloned BCV Seat	1
6	201364	AP-4 Casing O-Ring	1
7	201071	3" Extended Screen Sleeve	3
8	200916	BCV Spacer	3
9	201785	BCV Lock Washer	6
10	380339	3" Extended Screen	1
11	201389	Acorn Nut	3

Figure 20 - Bottom Intake Check Valve Assembly



No.	Part No.	Description	QTY.
1	205599	Check Valve Housing, Brass	1
2	201852	7/8" Ball	1
3	205597	Adapter 1" FPT X 1" MPT, Brass	1
4		*Specify= Hose or Tubing and Size*	1

Figure 21 - Exploded View of 1-Inch Brass Check Valve

Iron Build-up Cleaning Procedure

After the casing has been removed from the AutoPump please follow the procedure below:

Note:
The procedure described below can be seen in the Maintenance Video Tape. This will aid the technicians understanding and ease of properly disassembling the AutoPump, effectively cleaning components and then re-assembling the AutoPump.

STEP 1 - The bottom intake check valve assembly should be removed from the casing. **(See page 49, and Figure 15 on page 50)**

STEP 2 - Visually inspect both the 1 inch stainless steel fluid discharge pipe for iron build-up or debris. Also, do the same with the float that rides up and down on the SS discharge pipe.

STEP 3 - Should there be iron deposits on either or both the discharge pipe or float, then remove the float from the SS fluid discharge pipe as follows:

- Remove the control rod guide. **(See Figure 16 and Figure 17)**
- Remove the small SS pin from the bottom spring cup "Stop". The Stop is the small white part located just below the Spring identified on **Figure 16 and Figure 17**. The pin and Stop removal will allow you to remove the spring and float from the SS discharge pipe.

STEP 4 - The 1 inch stainless steel fluid discharge pipe can now be cleaned using either a Scotch Brite pad, a wire brush or finally a wire wheel on either a drill or a grinding machine. After removing the iron debris, it is recommended the pipe be water rinsed.

STEP 5 - Usually the AP-4 float will be one of two types. Most floats have a metal plate on each end. The second type of float has round pins protruding into its center hole, and it does not have metal plates.

Both the internal and external surfaces of the float will generally require cleaning. The material choices include a Scotch Brite pad, and a light grade 150 sandpaper.

For floats with plates: If these plates are removed to ease cleaning, they should be replaced on the same float end from which they came. That is, the plates should maintain their original top and bottom positions.

For floats without plates: A knife may be used to aid in cleaning this float.

STEP 6 - The white plastic square Control Rod is the next component to be cleaned. The control rod is the item that fits through the smaller hole in the float and is adjacent to the SS discharge pipe in the assembled pump. Again, use the Scotch Brite pad or a razor or Exacto knife (not sandpaper).

STEP 7 - The final component to be cleaned is the outer AutoPump casing. Please note you may either have a stainless steel or FRP fiberglass pump casing. The fastest and most effective way to clean out the inside surface of the pump casing is to use a three-stone honing tool. The technique is to move the hone in-and-out a half dozen times or so through each end of the casing. The time for the casing cleaning should take no longer than 5 minutes.

The AutoPump is now ready for re-assembly by following the steps above in reverse order.

Installing Pump Casing

STEP 1 - Inspect the O-rings to ensure they are capable of sealing (no discernible cuts or abrasions).

STEP 2 - Lubricate both inside ends of the casing to a depth of 3-4" with a thin layer of food-grade grease. Ensure that the film reaches the edges of the casing.

STEP 3 - Place the bottom check valve (Bottom Loading Pump) or bottom plug (Top Loading Pump) upright on a clean level surface.

STEP 4 - Pull the casing down over the check valve or plug.

Warning:
The pump casing has beveled ends that allow it to slide over the O-rings easily. Keep fingers, hands and other body parts away from these edges as they approach the heads. These edges can pinch when the pump casing is slid over the lower and upper heads.

STEP 5 - Turn the pump upside down and spin the casing assembly on the discharge tube by hand until the edge of the casing contacts the O-ring on the pump head.

Caution:
Be careful to swing the counterweight inside the pump.

STEP 6 - Using a spanner wrench on the bottom fitting, or, a strap wrench on the bottom end of the casing (pump bottom), turn the parts together until the casing just contacts the pump head.

STEP 7 - Turn the bottom check valve or the plug in the reverse direction (counter clockwise) so it is looser by 1/4 turn.

Cleaning the Pump Cycle Counter

Refer to Appendix F – Pump Cycle Counter

Checking Volumes Pumped Per Cycle

See page 23 for information on the AutoPump volumes pumped per cycle. Ensure that volumes correspond with the previous experience on-site, and with the ranges indicated on page 23. If it doesn't correspond, then one of the following may exist:

1. The AutoPump is malfunctioning. **(See Chapter 7: Troubleshooting & Repair)**

2. The Pump Cycle Counter may not be counting correctly. See **Appendix F – Pump Cycle Counter** for troubleshooting procedures.

3. Site conditions (e.g. air pressure, discharge head) may have changed substantially.

Chapter 7: Troubleshooting & Repairs

Problems may occur and usually can be easily resolved by following these instructions. If, after careful reading and service, you cannot resolve the problem, please contact the *QED Environmental Systems (QED)* Service Department at (800) 537-1767.

Caution:
Wear goggles, gloves, and coveralls when servicing this system.
After troubleshooting is completed and before assembling the pump, slowly move the float through its range to ensure that the lever will trip even if the pump fills and empties slowly.

Note:
See Chapter 6: Maintenance for disassembly and cleaning instructions.

Possible Causes	Symptoms		
Detailed Instructions Follow this Chart	Pump not cycling	Pump Cycles, but volume is reduced or there is no discharge	Air in fluid discharge
1. Air supply	X		X
2. Fluid level	X		
3. Air exhaust restricted	X		X
4. Fluid inlet clogged	X		
5. Debris, scale or very viscous fluid	X	X	X
6. Float pins	X		X
7. Lever pivot wear	X		X
8. Debris in air inlet valve	X		
9. Fluid check valve		X	
10. Valve timing	X		

Troubleshooting

1. Air Supply:

- If the air pressure is too low, or if the flow is severely restricted the pump will not cycle. Check the flow by inserting the pump air fitting part way into the air line socket. A healthy discharge of air should result.

- If the air pressure exceeds the design limitations of the pump, the pump may fail to cycle, or the exhaust valve may have locked up and cause air to enter the fluid discharge.

2. Fluid Level:

- The fluid level must be above the fluid inlet on a Top-Loading pump. On a Bottom-Loading pump, the fluid must be no lower than 9 inches below the head of the pump.

3. Air Exhaust Restricted:

- The exhaust line must not be kinked, plugged, or too small in diameter.

- The air exhaust outlet must be above the fluid level.

- If the air exhausts in the well, the well must be vented to the atmosphere or a functioning vapor recovery line.

- If the air exhausts to the atmosphere (outside the well) and a vacuum is drawn on the well, the pump may fail to fill. In order for the pump to fill under these adverse conditions, the pump must be submerged to make up for the pressure difference between the atmosphere and the partial vacuum in the well.

  The pressure difference, expressed as feet of water column (FT. W. C.), is how far the fluid must be above the pump before it can fill.

- **See Appendix D** if there is a vacuum on the well.

- Ice may be forming on the exhaust valve seat due to the temperature drop that accompanies expansion of compressed air. Restrict the exhaust to lower the expansion rate of the exhaust. Restrict the air inlet hose or lower the pressure to reduce the rate of incoming compressed air. The previous three suggestions may reduce the flow rate from the pump. Submerge the head of the pump, if it is not already submerged. Protect the air lines from low temperatures and freezing by burial or insulation.

4. Fluid Inlet Clogged:

- If the fluid inlet screen is clogged with debris, or if a Bottom-Loading pump is on the bottom of the well, water cannot enter the pump.

5. Debris, Scale, or very Viscous Fluid:

- If debris, scale or a very viscous fluid has accumulated inside the pump, the float may not move freely up and down, or the control rod may not slide easily through the float.

- Clean the float, control rod, and the casing. See **Chapter 6** for cleaning instructions.

6. Float Pins:

- Determine if any part of the float material itself can contact the discharge pipe. Move each end of the float back and forth, sideways, to ensure that the pins prevent float contact. Call *QED* for repair options.

> **Note:**
> If viscous materials cause continual problems, contact QED for possible solutions.

7. Lever Pivot Wear:

- Grasp the center of the lever with thumb and forefinger. Rotate the lever to horizontal.

- Push up and down, toward and away from the head. Confirm that there is less than 1/32 inch of movement.

- Replace the levers if the pivot hole is worn

8. Debris in Air Inlet Valve: (First check #7-Lever Pivot Wear)

- Open the pump. Connect the air supply. Pull the control rod down. Listen to determine if air leaks through. If so, clean the valve by blowing air or water through it from both ends.

- If air still leaks through the valve with the control rod down, the air-hose must be removed to access the valve inlet to check for debris in the valve or in the hose pigtail.

- Push the rod upwards. If little or no air passes through, remove the air-in hose to access the valve inlet. Blow air through the valve from the poppet side to clear debris from the ball and seat.

9. Fluid Check Valves:

- Open the pump. Hold the pump vertically and pour water into the discharge check valve. If water flows through, clean the valve.
- Remove the valve and use emery cloth or a very fine sand paper to polish the surface where the ball seats.
- If the pump is a Bottom-Loading design, inspect the seat of the bottom check valve for debris and wear. Clean or replace if necessary.
- If the pump is a Top-Loading design, remove the fluid inlet check valve and inspect the seating surface and the ball for debris and wear.

10. Air Inlet Valve Timing:

- (First check lever pivot wear per #7)
- Call the QED Service Department for correct air valve timing for your pump.

Returning Equipment for Service

If the equipment needs to be returned to *QED* for servicing, please follow these steps:

STEP 1 - Call the *QED* Service Department and obtain a Return Material Authorization **(RMA)** number. Please have available the customers contact person's name, company name and address, phone number, fax number, reason for the return, and the names of the chemicals to which the equipment has been exposed.

STEP 2 - Clean all equipment before shipping. See **Equipment Cleaning Requirements** at the end of this section.

If the equipment must be cleaned after it arrives at *QED*, the customer will be charged for the cleaning and disposal of material, if necessary. (Cost can be $200.00 per piece of equipment cleaned.) Drain and dry all equipment after cleaning.

STEP 3 - Package the equipment so that it will not be damaged in shipment. Use bubble pack rather than styrofoam flakes as packing material.

STEP 4 - Ship the equipment via a carrier and service level (i.e., one-day, two-day shipping) in consideration of probable service time and return shipment time.

STEP 5 - It is recommended that such shipments be insured so if the shipment is badly damaged or lost, the customer can replace the equipment at little or no cost.

STEP 6 - Include the contact's name, company, phone number and RMA number given by *QED*.

STEP 7 - Write the RMA number on the outside of the packaging so it will be directed immediately to the *QED* Service Department.

000292

Equipment Cleaning Requirements

If the equipment is to be shipped to another site or to the factory for service, it needs to be thoroughly cleaned before leaving the site. Cleaning the equipment protects the user (sender), the shipper, and the receiver from dirt and/or contaminants. If the equipment is not cleaned prior to shipping for servicing, it may be severely delayed, refused or the shipper may be charged a cleaning fee. Before packing and shipping, ensure that the equipment is dry inside and out.

The following is a list of equipment and how it should be cleaned prior to shipment.

Hoses and Fittings

STEP 1 - Pump clean water or water with a gentle soap solution (e.g. Dove Dish Soap) through the pump to remove free product and particles.

STEP 2 - Rinse all soap off of the equipment.

STEP 3 - Soak and rinse the outside of the unit with water to remove loose debris and dirt.

STEP 4 - Steam clean inside and out to remove difficult dirt and contaminants.

Caution:
Use low pressure (less than 40 psi) when steam cleaning.

AutoPumps

STEP 1 - Pump clean water or water with a gentle soap (e.g. Dove Dish Soap) solution through the pump to remove free product and particles.

STEP 2 - Rinse all soap off of the equipment.

STEP 3 - Soak and rinse the outside of the unit with water to remove loose debris and dirt.

STEP 4 - Steam clean inside and out to remove difficult dirt and contaminants.

Caution:
Use low pressure (less than 40 psi) when steam cleaning.

Appendix A: Performance Curves

These curves were derived from in-house tests using a pump with average air flow capacity. Flow rates in the field may vary slightly due to temperature, air quality, flow restrictions and minor differences in pump adjustments. Flow rates can be affected due to the natural cooling effect of compressed air expansion. If this cooling effect is lowering the flow rate, decreasing the air pressure to the pump can actually increase the flow rate in some cases. Another way to reduce freezing of water vapor in compressed air is to use an air dryer on the compressed air line.

The following charts show the performance flow rate curves for Long, Short, and Low-Drawdown

Long Bottom and Top-Loading AP-4 AutoPumps (3.5-inch OD).
- For US units, see Figures 22, 23, 26, and 27.
- For Metric units, see Figures 24, 25, 28, and 29.

Short Bottom and Top-Loading AP-4 AutoPumps (3.5-inch OD).
- For US units, see Figures 30, 31, 34, and 35.
- For Metric units, see Figures 32, 33, 36, and 37.

Low-Drawdown Bottom and Top-Loading AP-4 AutoPumps (3.5-inch OD).
- For US and Metric units, see Figures 38, 39, 40, and 41.

The curves are categorized by pump type, hose size, depth of submergence and air supply pressure. To determine the flow rate a pump will produce, the following information must be known:

1. **Pump** – Long, Short or Low Dardown; Top- or Bottom-Loading.
2. **Discharge hose size** – 3/4-inch or 1-inch is standard. A larger inside diameter may yield a higher flow rate. This depends on site conditions.
3. **Fluid Inlet** Submergence – Select the submergence depth of the pump below the fluid under normal operating conditions.
4. **Air pressure.**

With the previous information, obtain the flow rate by using the following steps:

- On the horizontal scale, find the depth in the well at which the pump will be located.
- Trace that depth upwards to the line for the air inlet pressure you selected.
- Travel horizontally over to the vertical scale and read the flow rate.

Example: A long Bottom-Loading pump with a 1-inch discharge hose and 70 psi supply pressure positioned 100 feet below ground and submerged 6 inches below the fluid will produce about 4.5 gallons per minute (GPM).

The same pump submerged 10 feet below the fluid produces 6 GPM.

Note:
These flow rates are only applicable for the designated well head conditions. Any additional resistance from out-of-well equipment (e.g. surface hoses, valves, etc.) will affect the values shown on these curves.

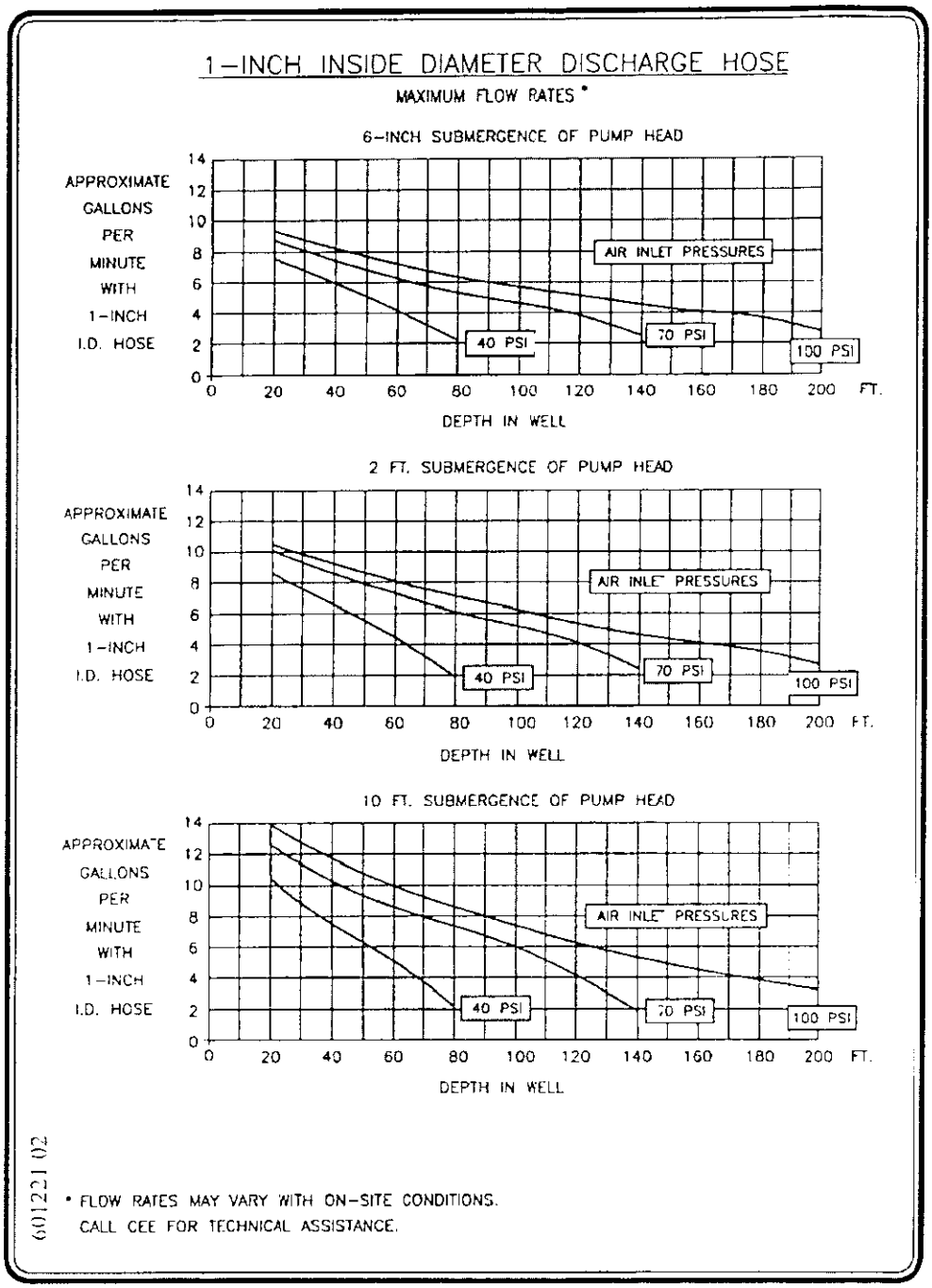


Figure 22 - Long AP-4/B1, Performance Curves: 1-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

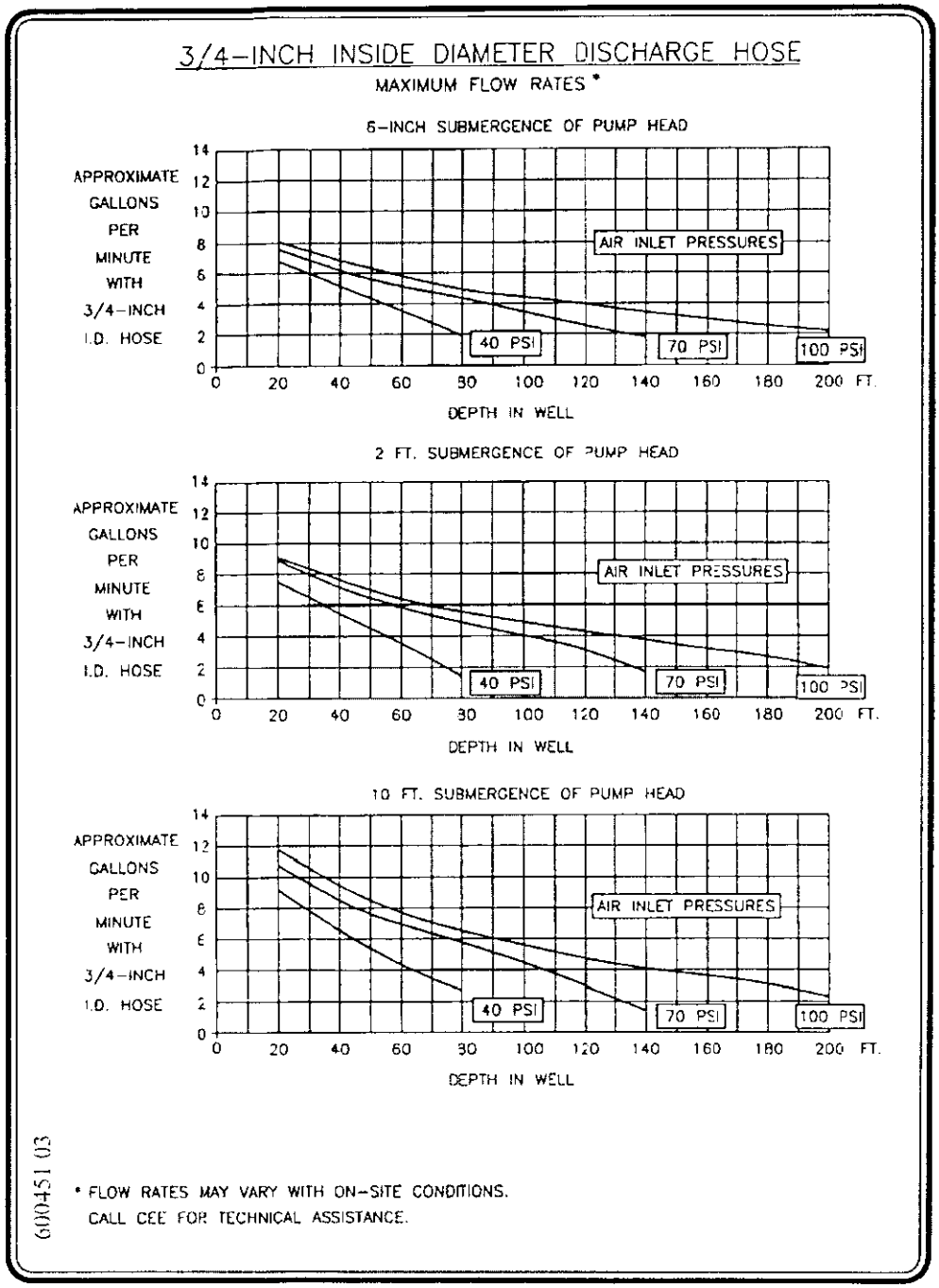


Figure 23 - Long AP-4/B1. Performance Curves: 3/4-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

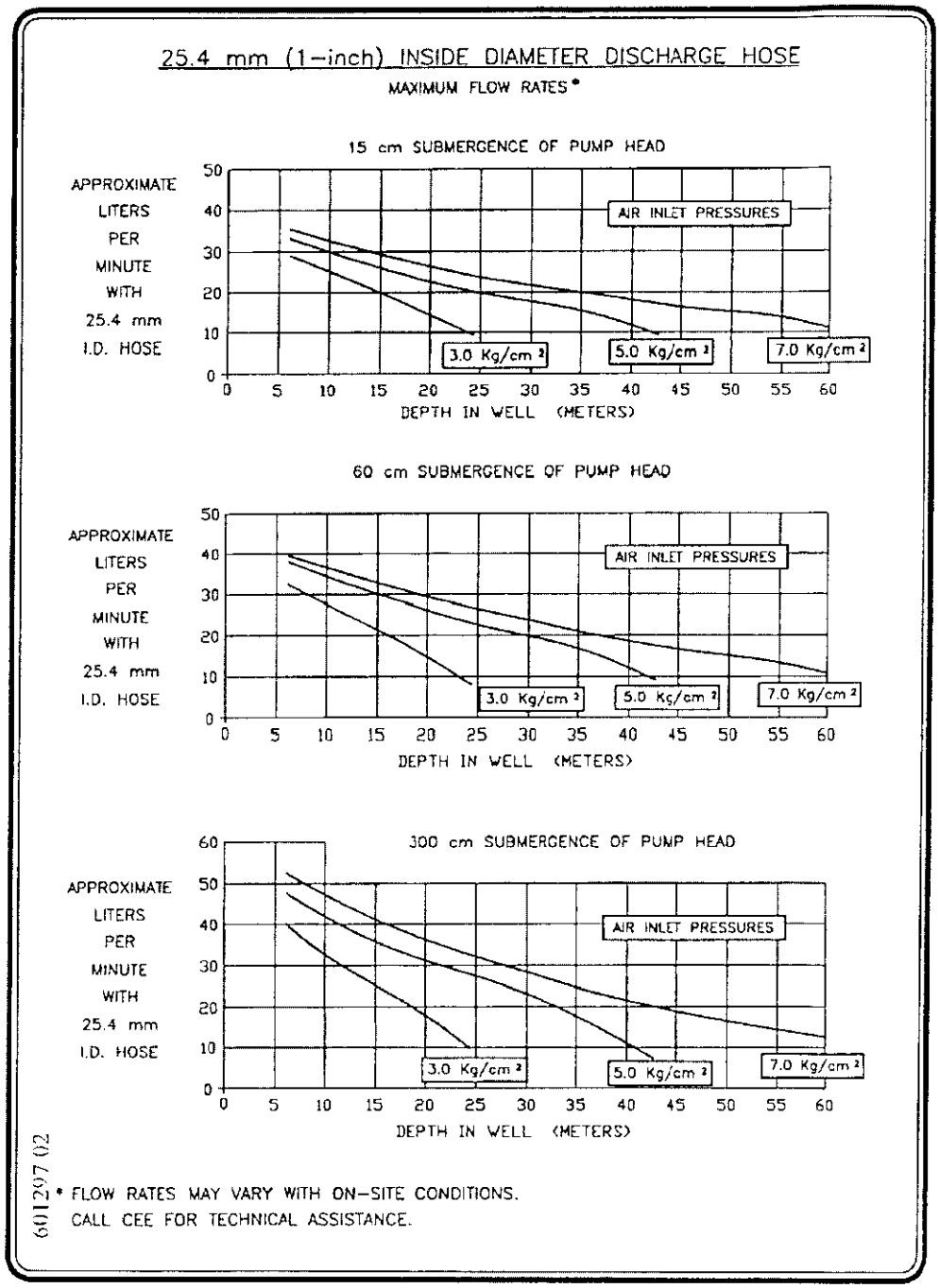


Figure 24 - Long AP-4/BL Performance Curves: 25.4 mm (1-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

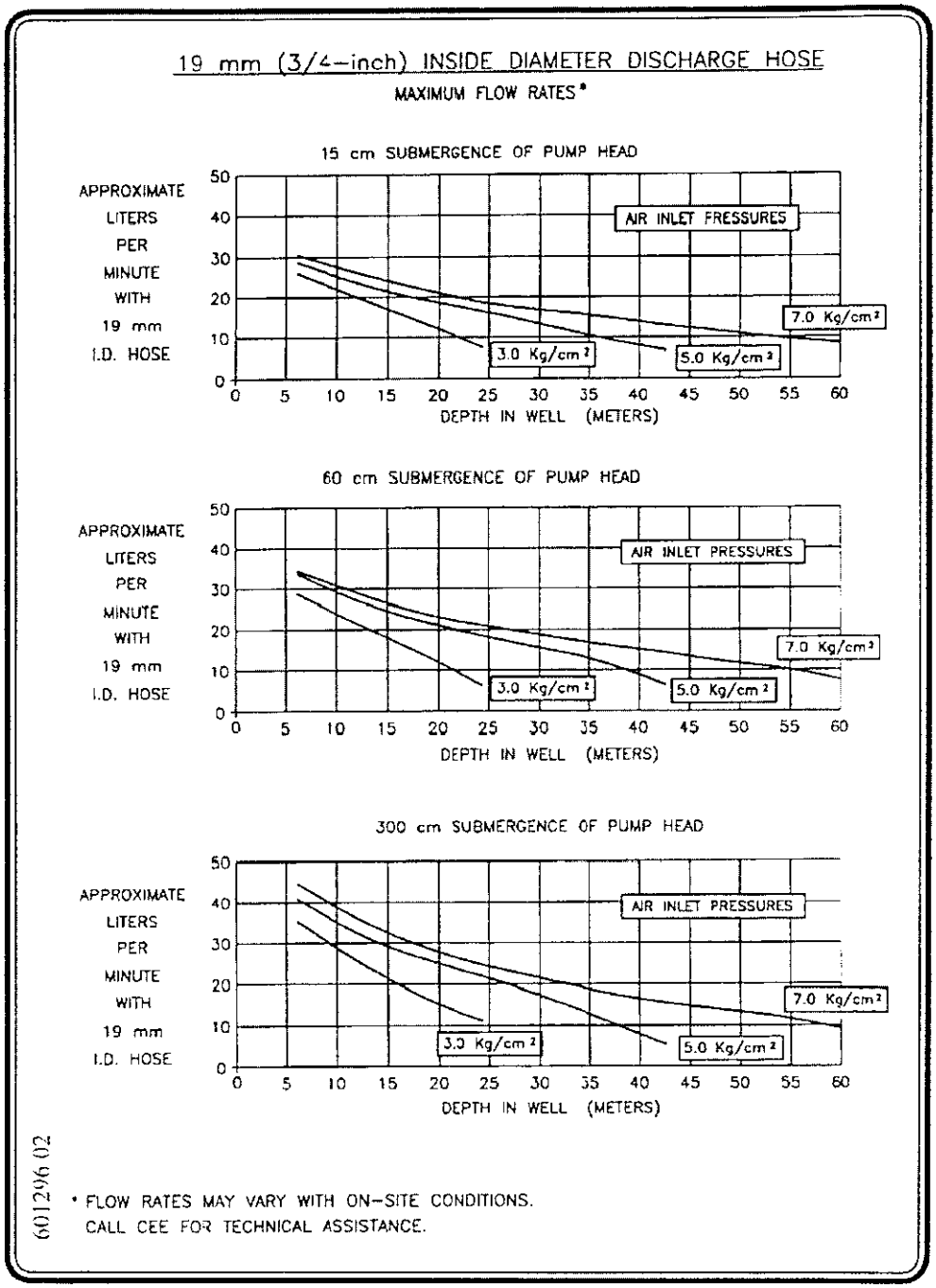


Figure 25 - Long AP-4/BL Performance Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

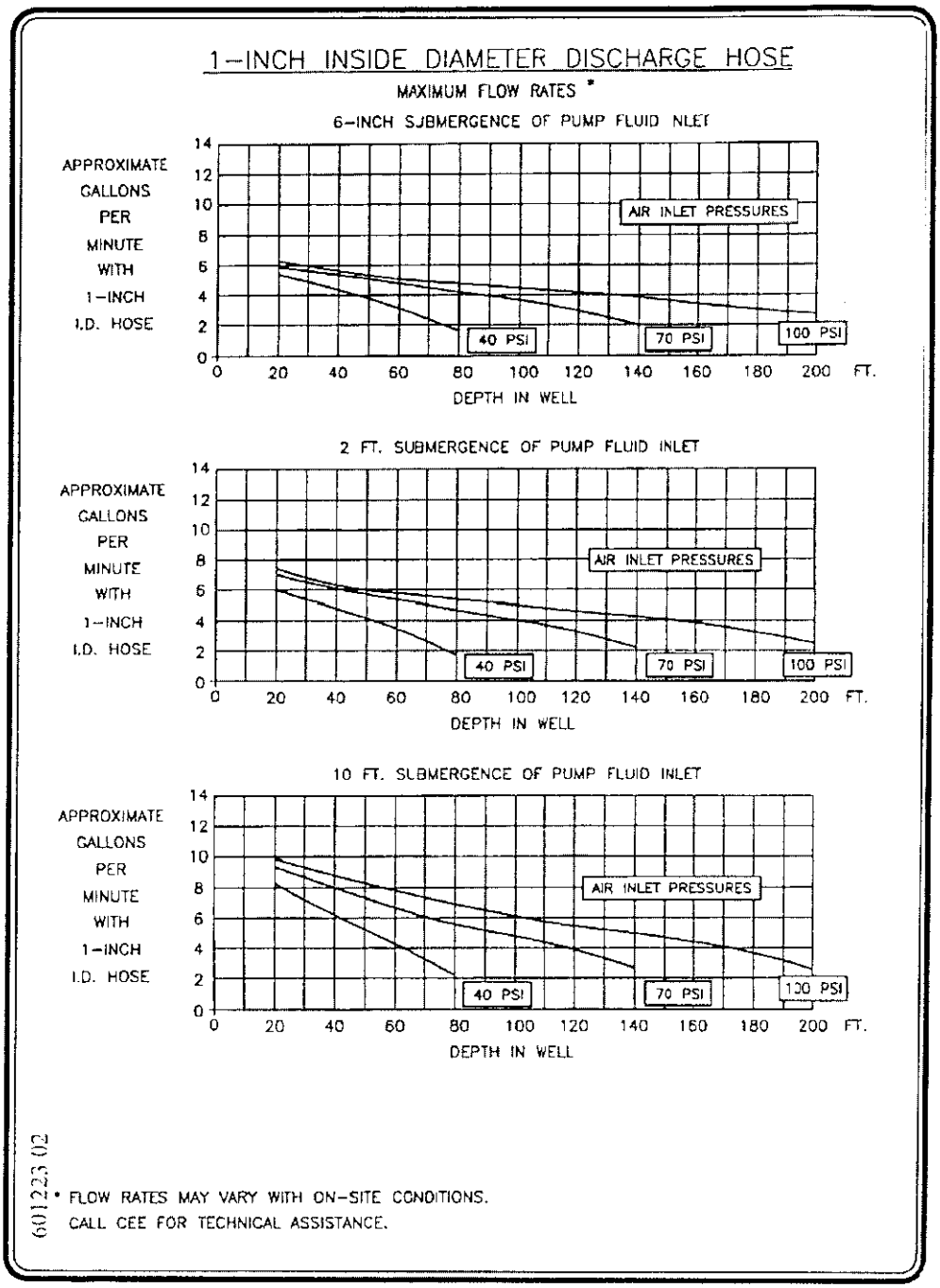


Figure 26 - Long AP-4/TL Performance Curves: 1-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

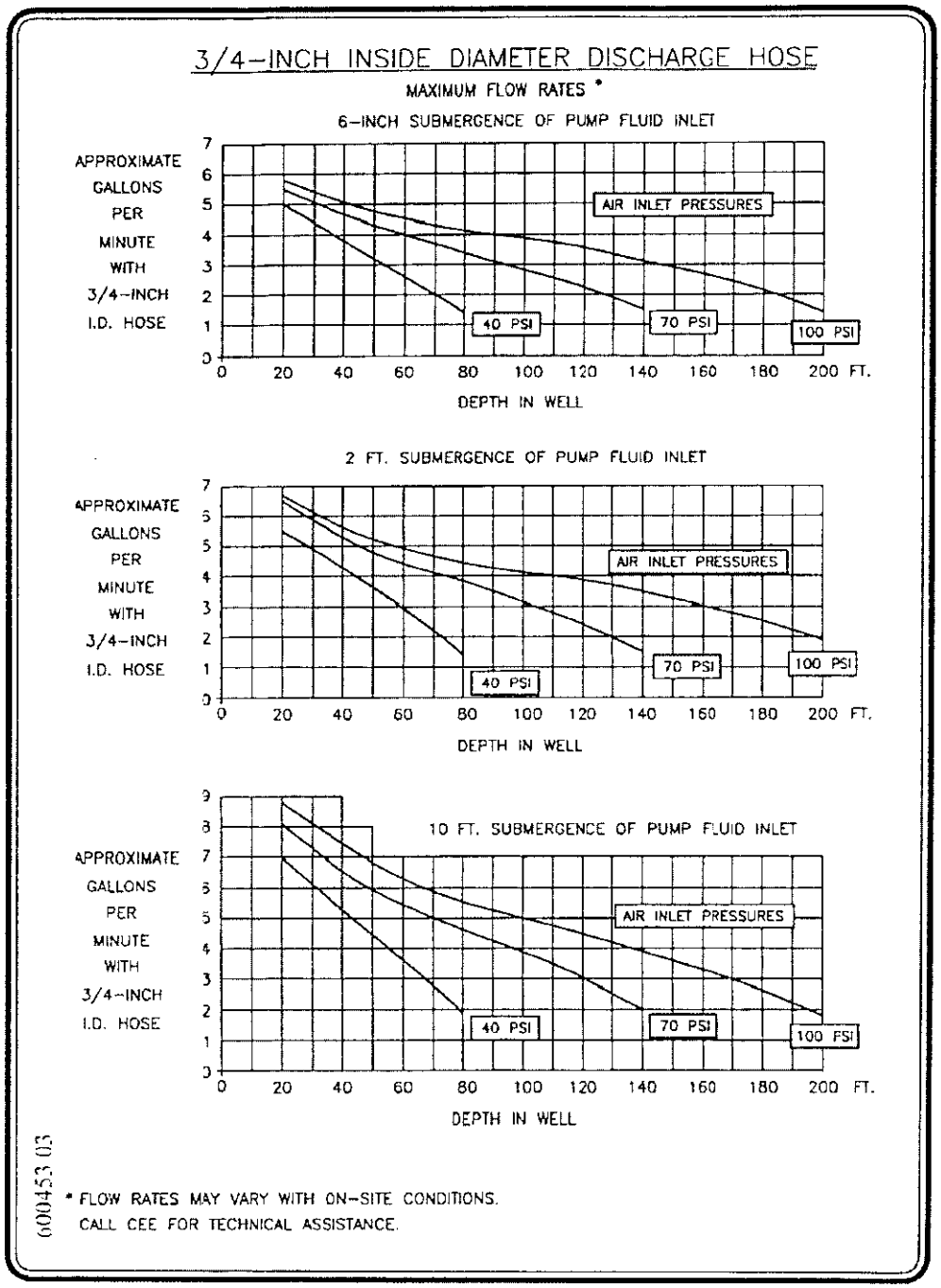


Figure 27 - Long AP-4/TL Performance Curves: 3/4-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

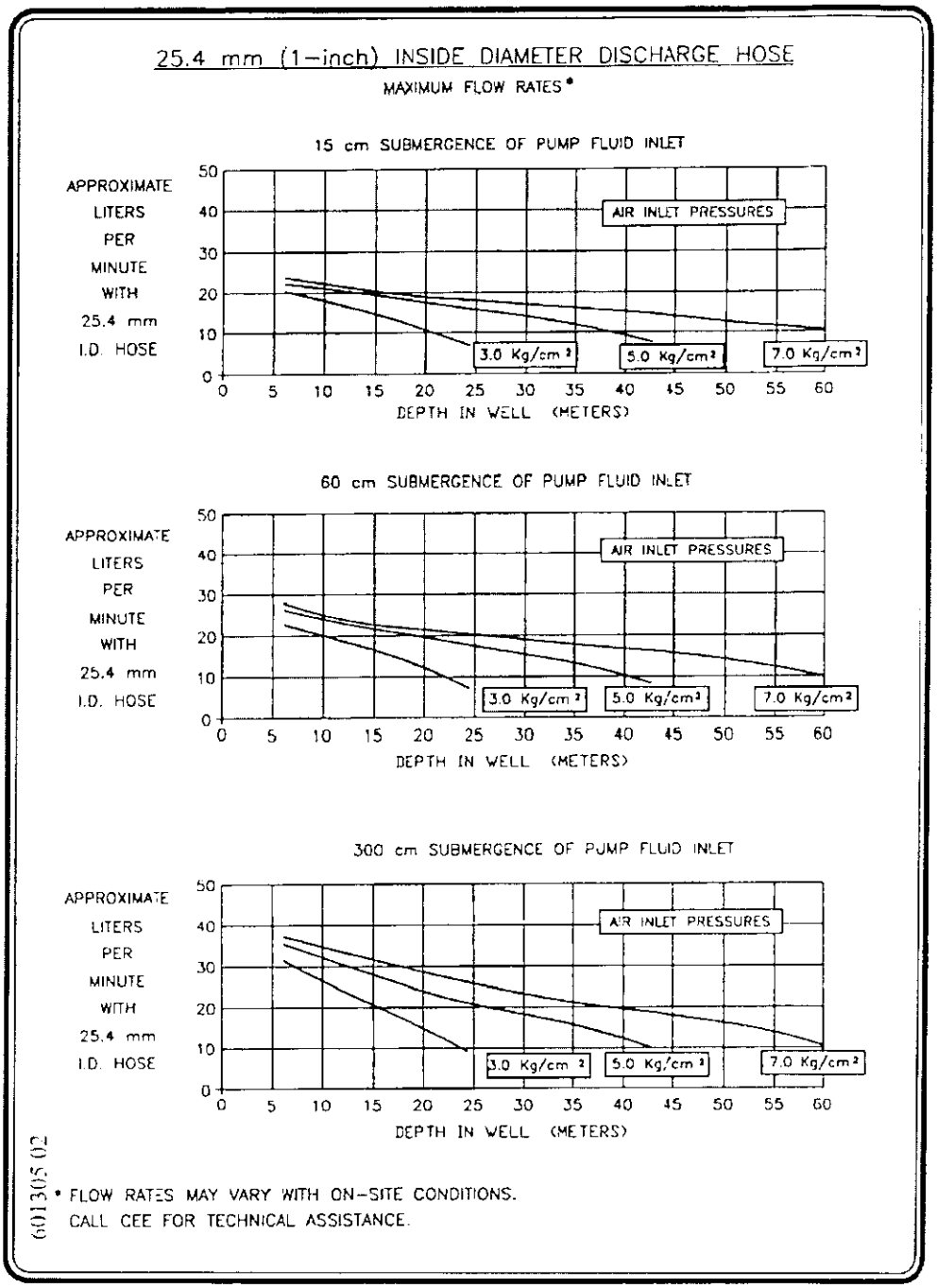


Figure 28 - Long AP-4/TL Performance Curves: 25.4 mm (1-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

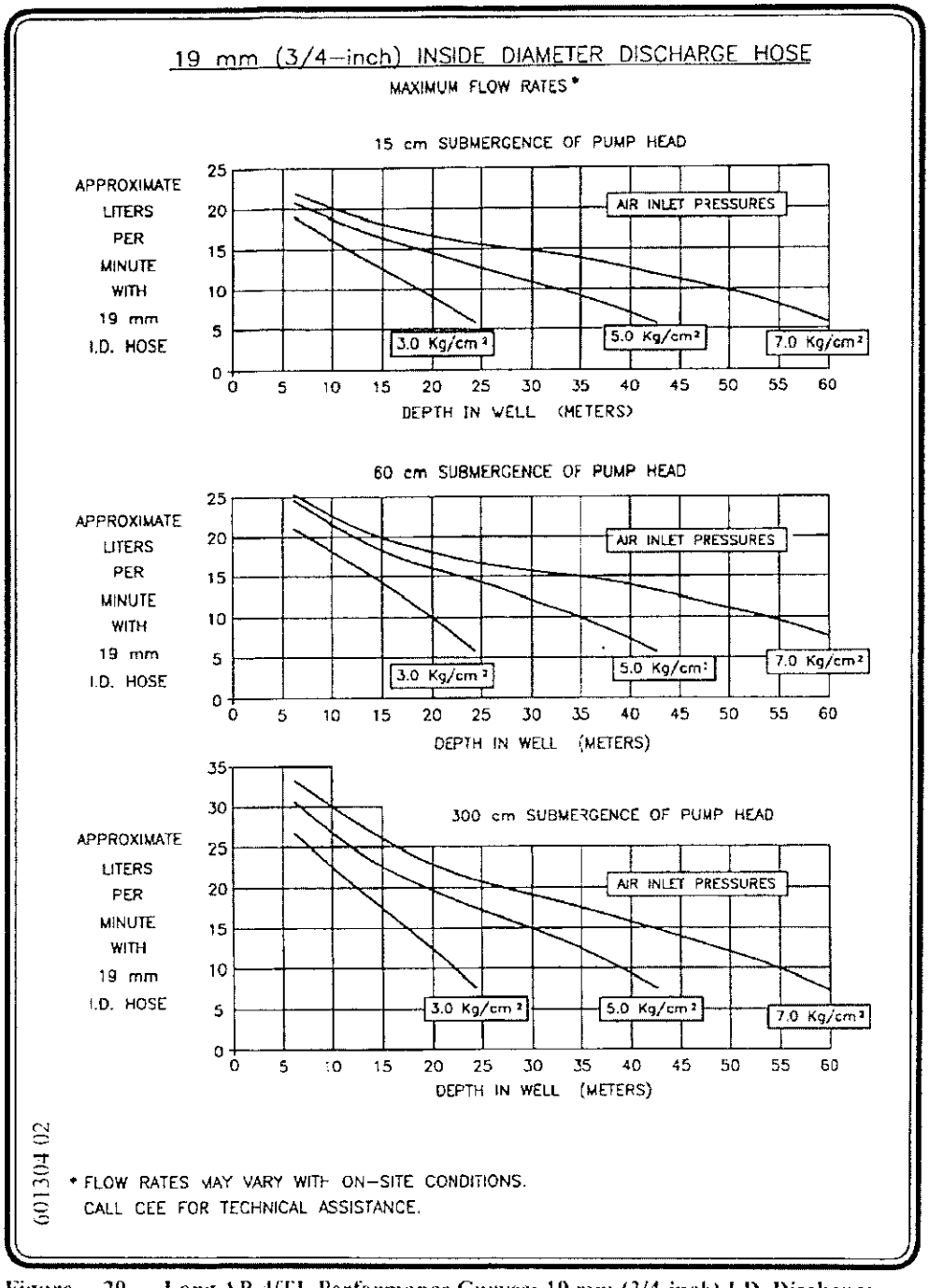


Figure 29 - Long AP-4/TL Performance Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

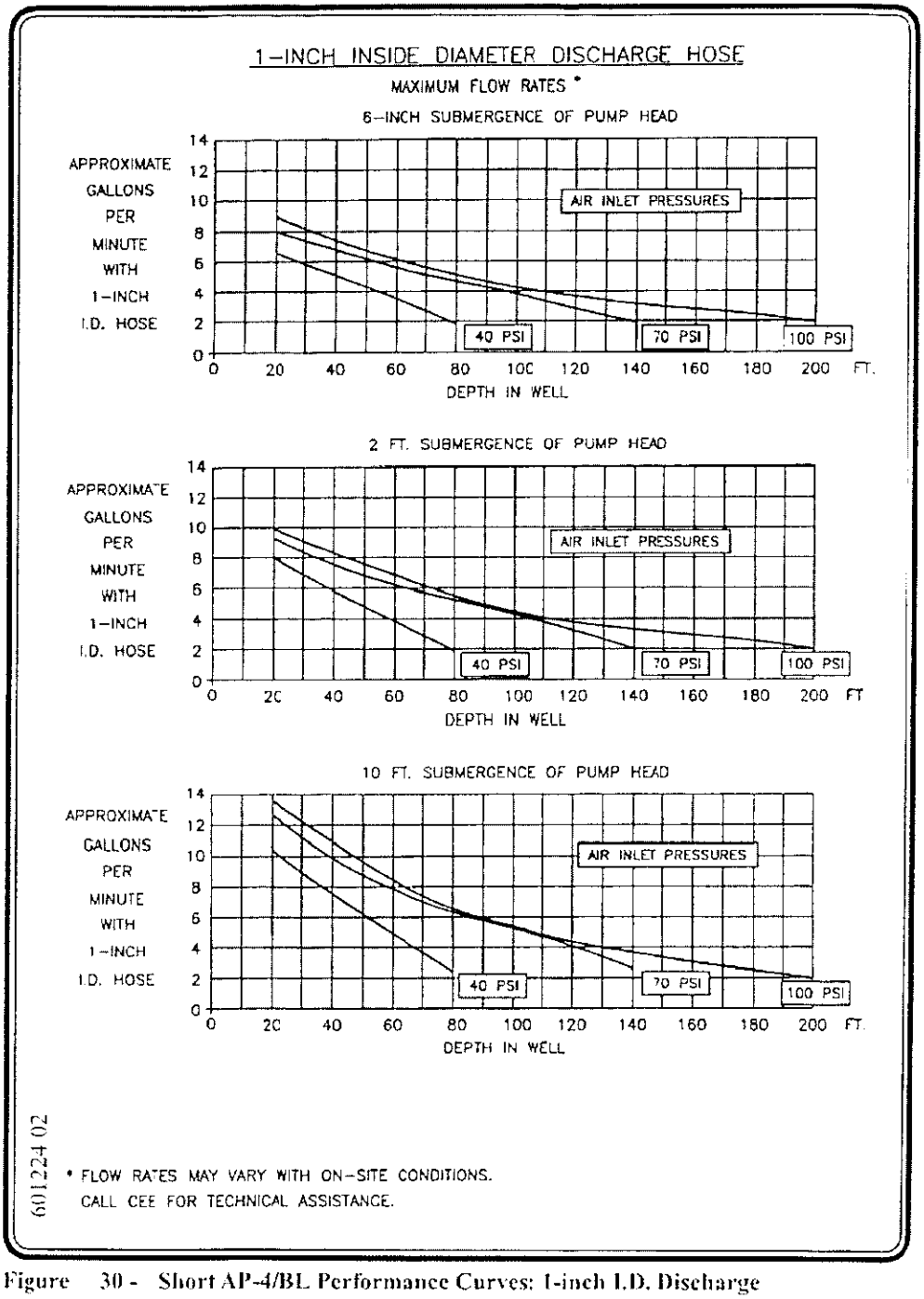


Figure 30 - Short AP-4/BL Performance Curves: 1-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

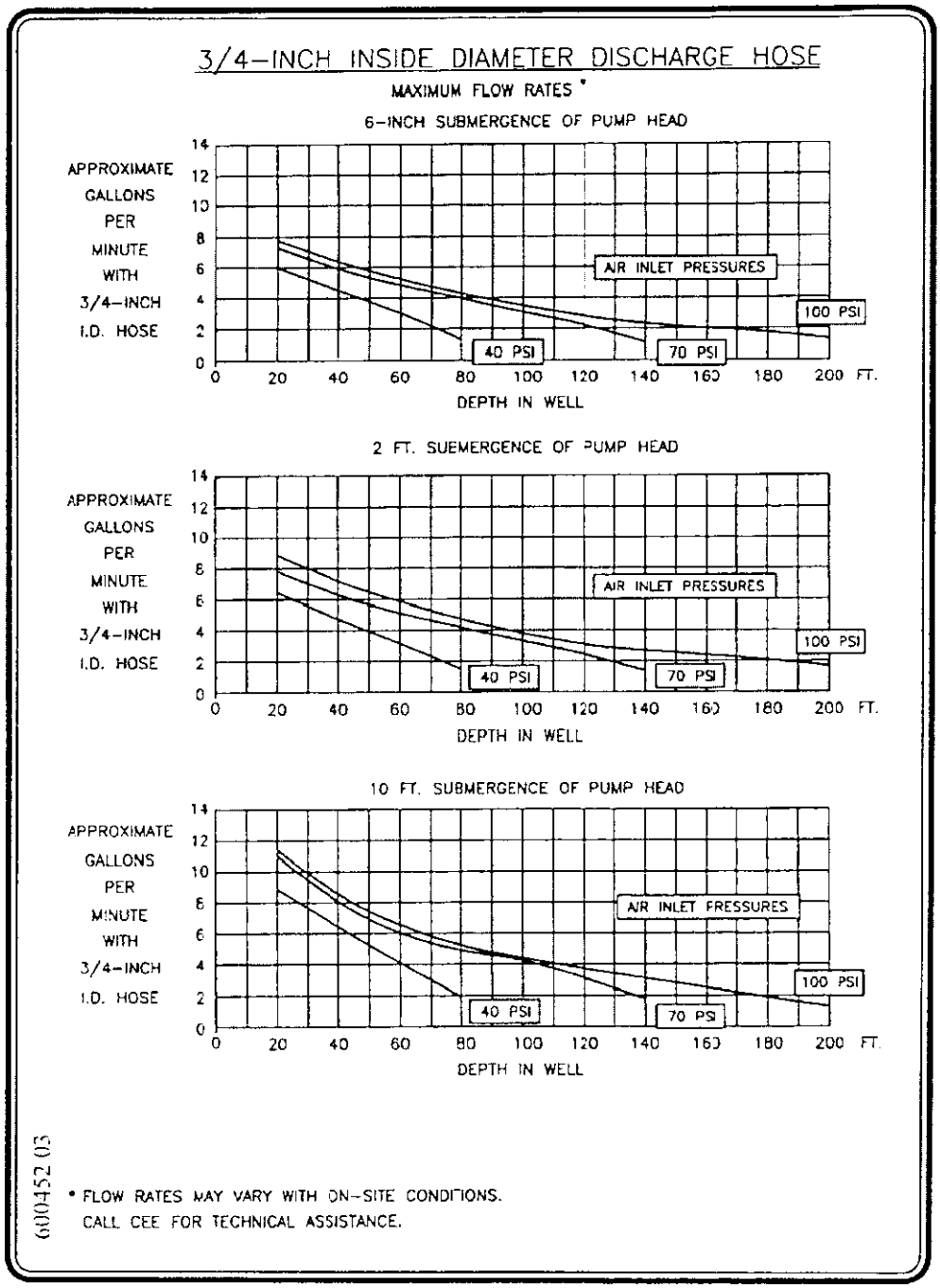


Figure 31 - Short AP-4/BL Performance Curves: 3/4-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

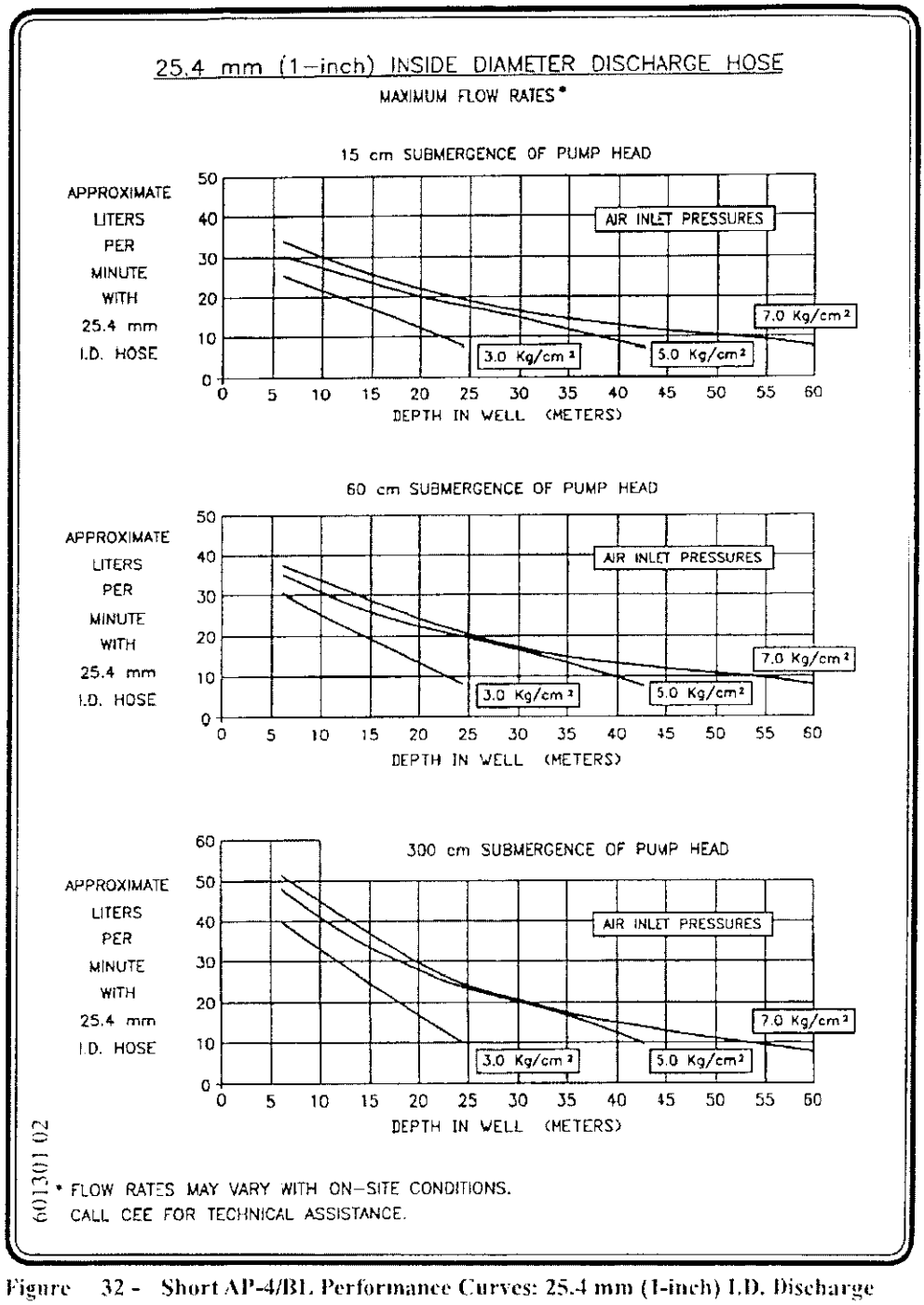


Figure 32 - Short AP-4/BL Performance Curves: 25.4 mm (1-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

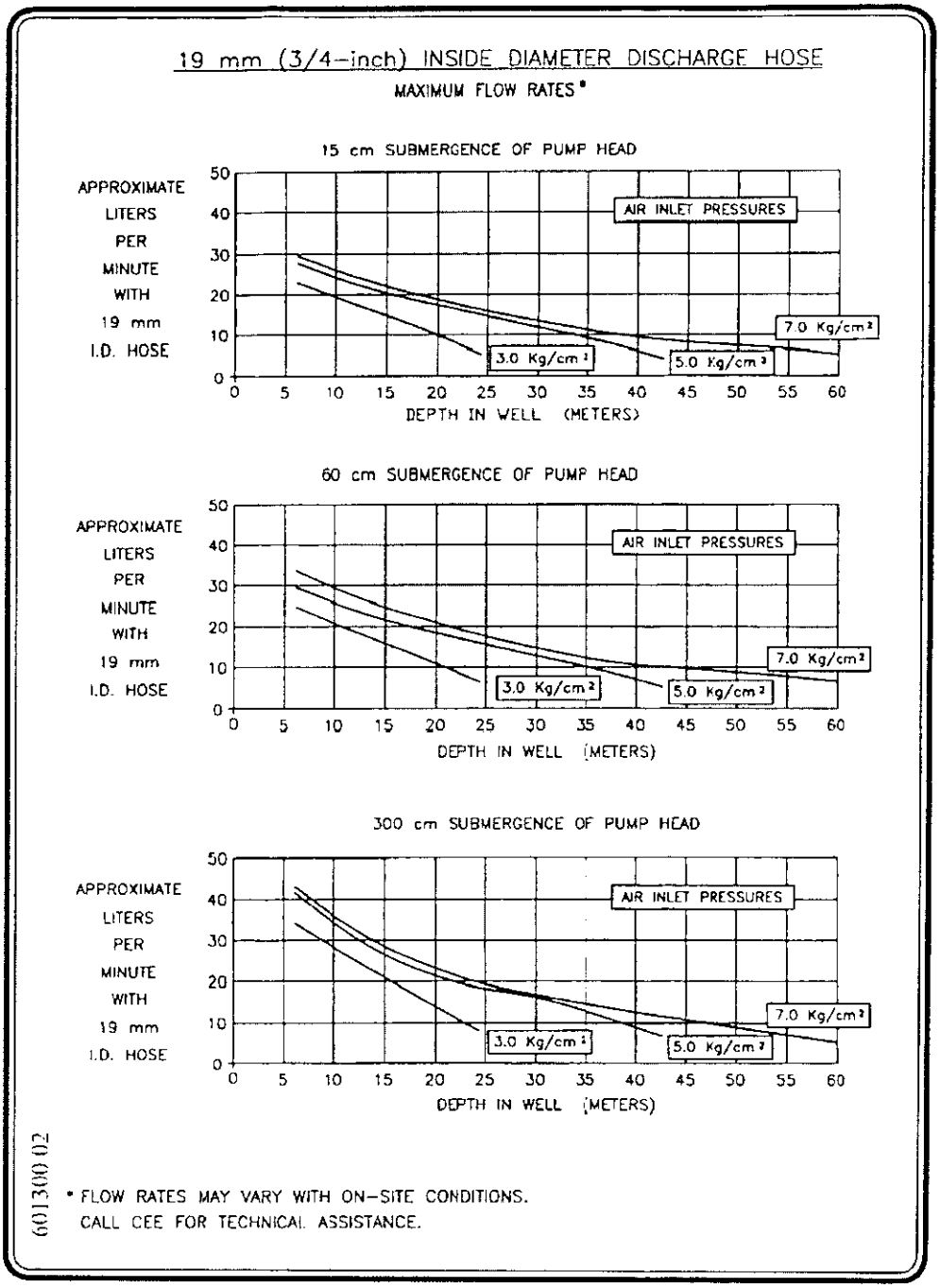


Figure 33 - Short AP-4/BL Performance Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

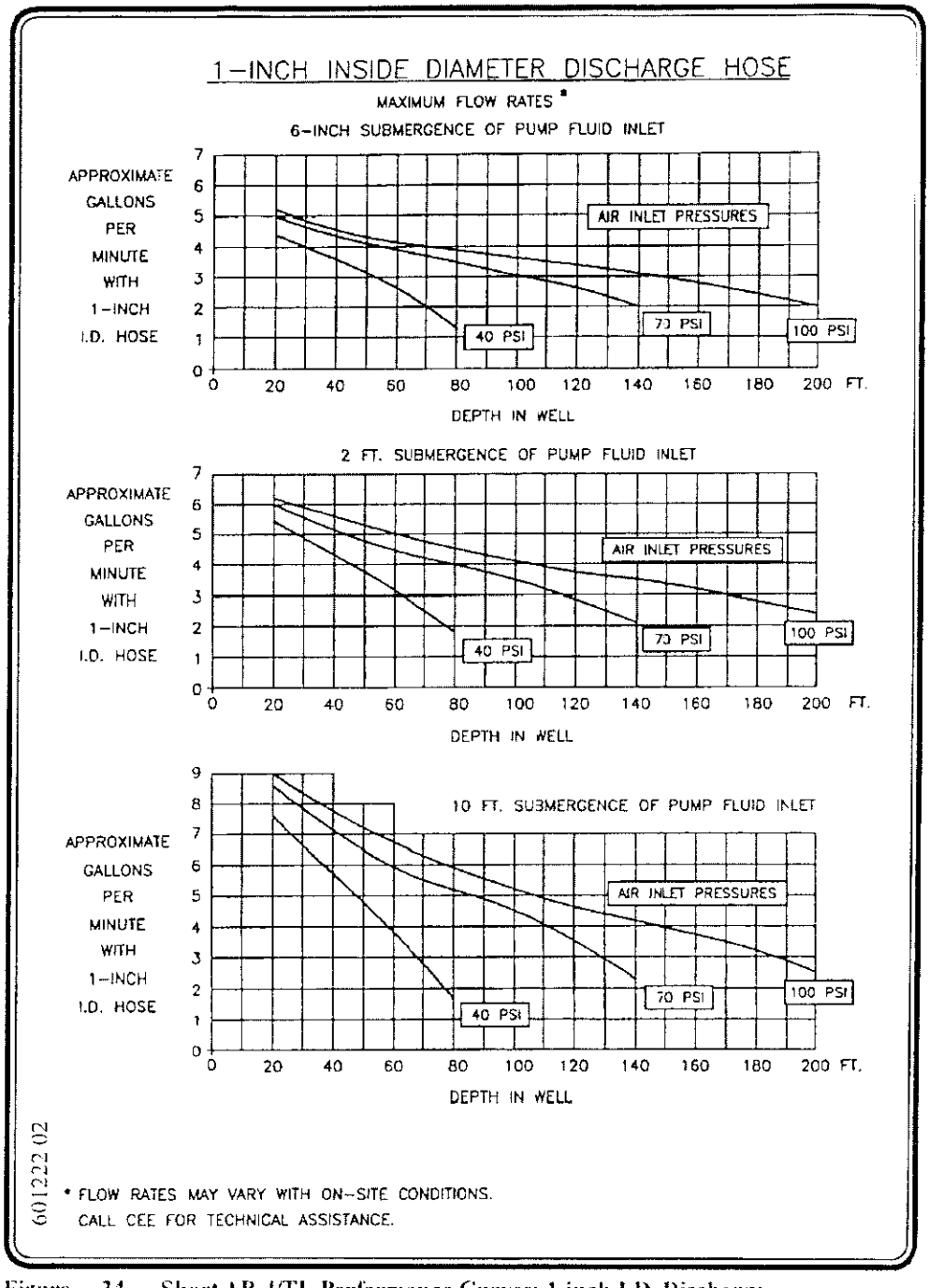


Figure 34 - Short AP-4/TL Performance Curves: 1-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

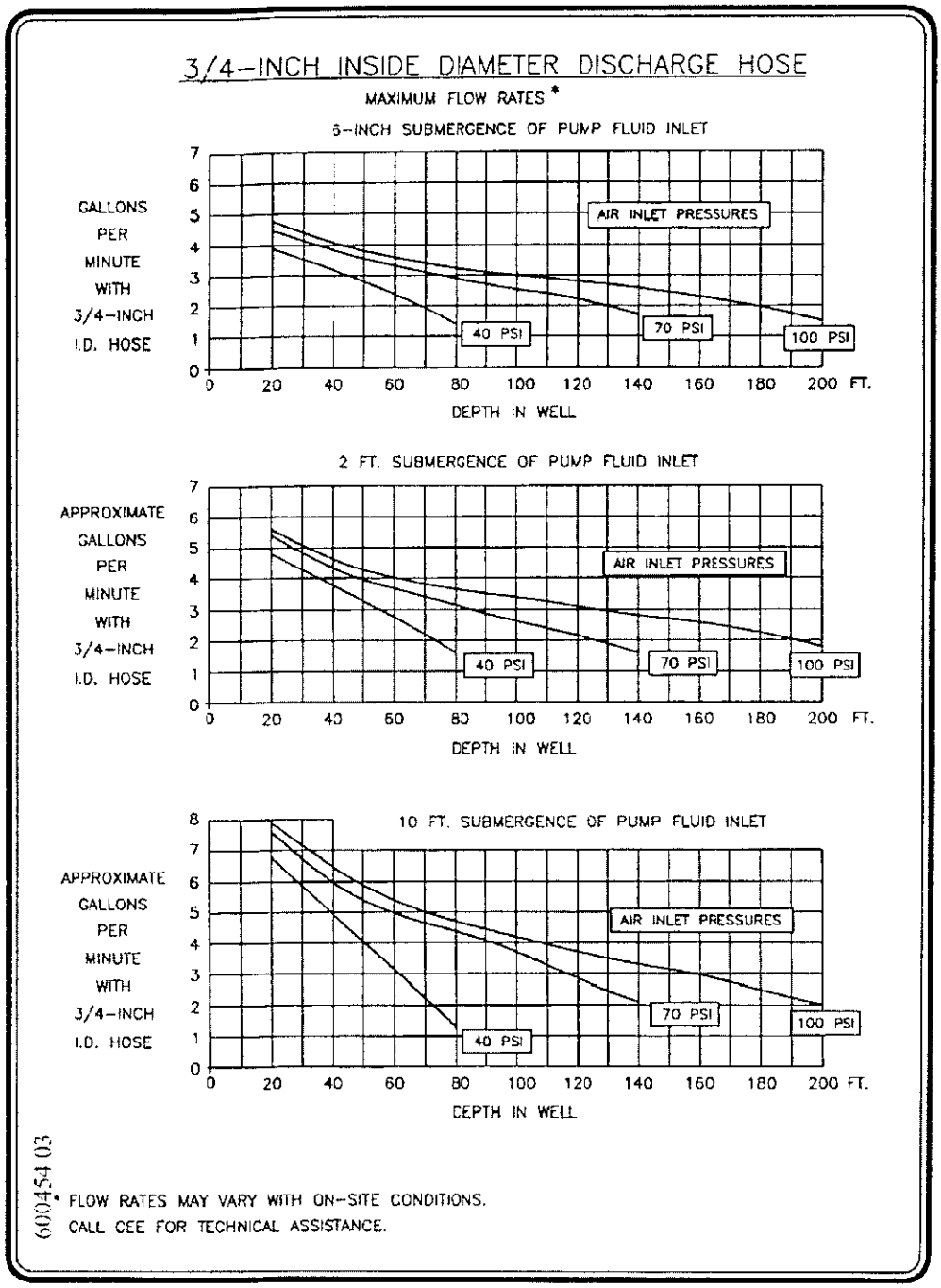


Figure 35 - Short AP-4/TL Performance Curves: 3/4-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

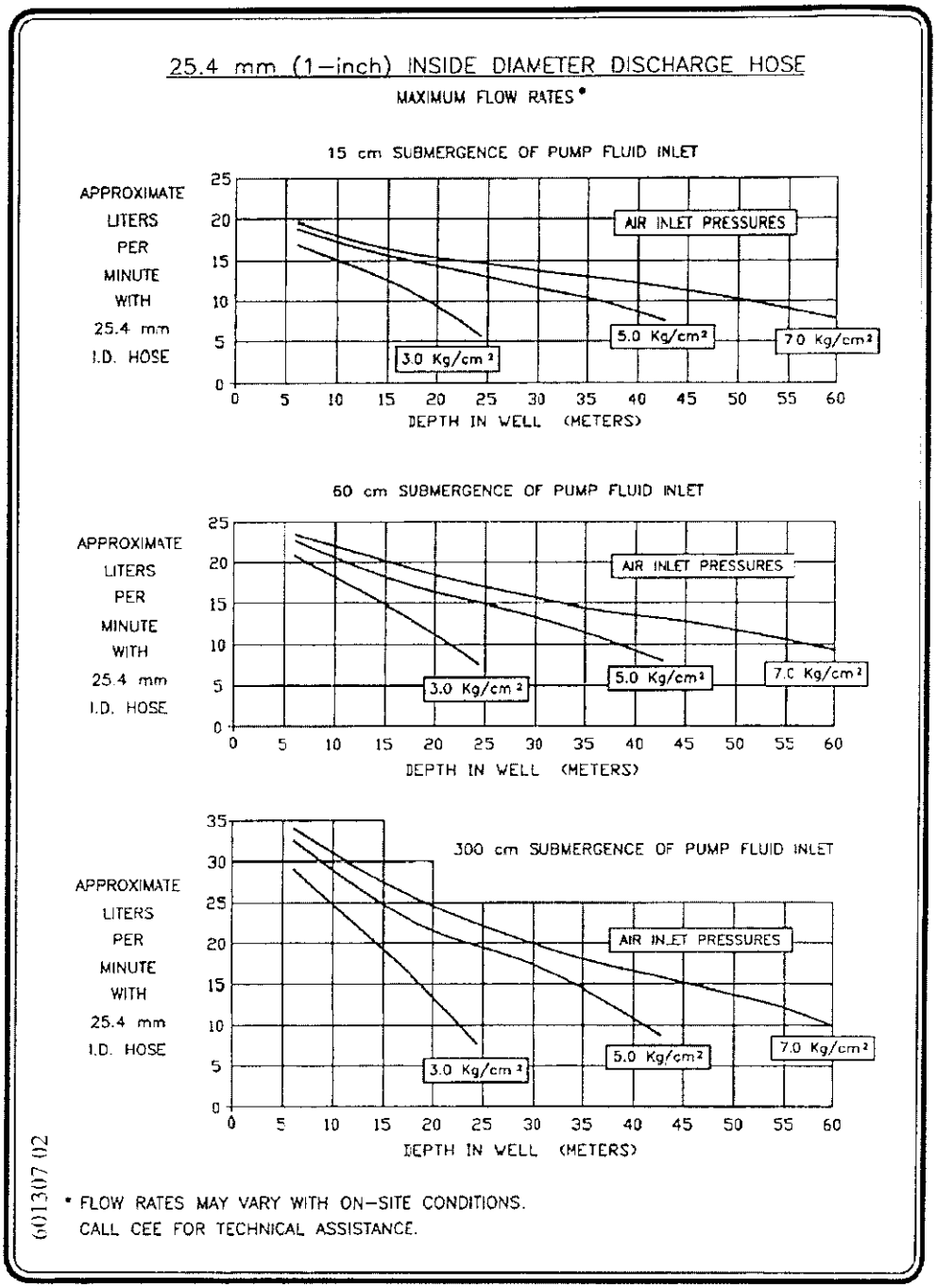


Figure 36 - Short AP-4/TL Performance Curves: 25.4 mm (1-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

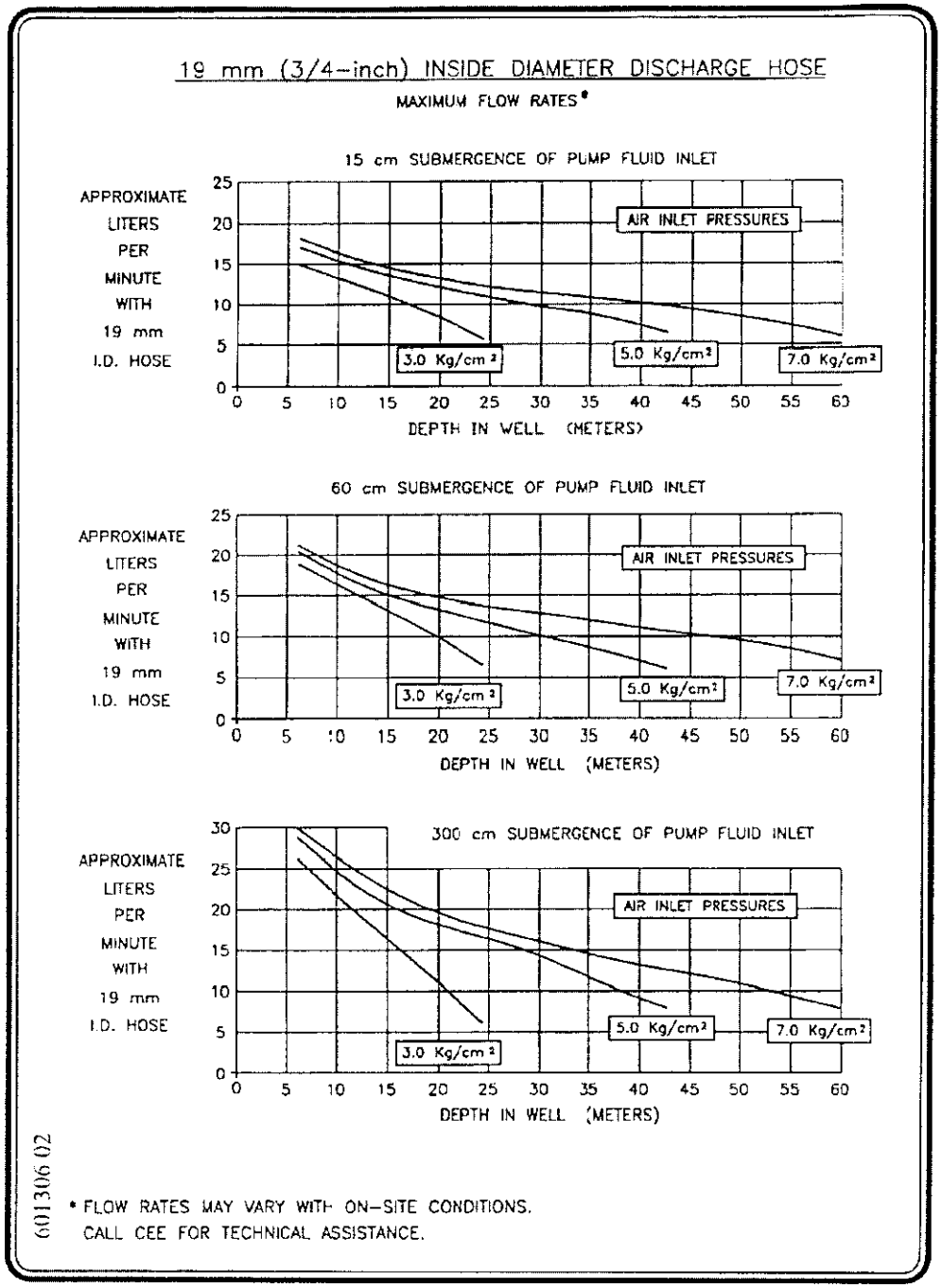


Figure 37 - Short AP-4/TL Performance Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

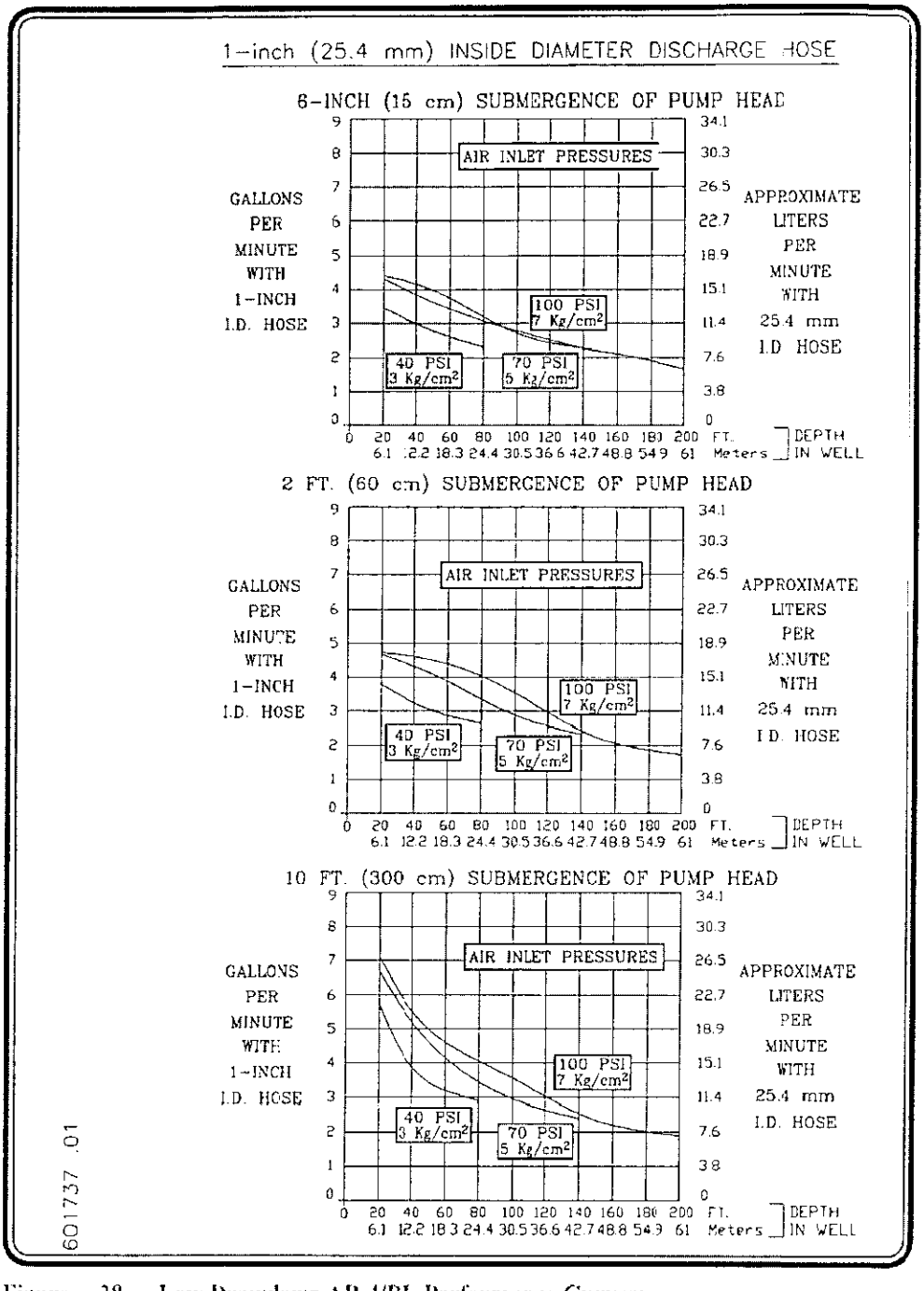


Figure 38 - Low Drawdown AP-4/BL Performance Curves: 1-inch (25.4 mm) I.D. Discharge US and METRIC UNITS

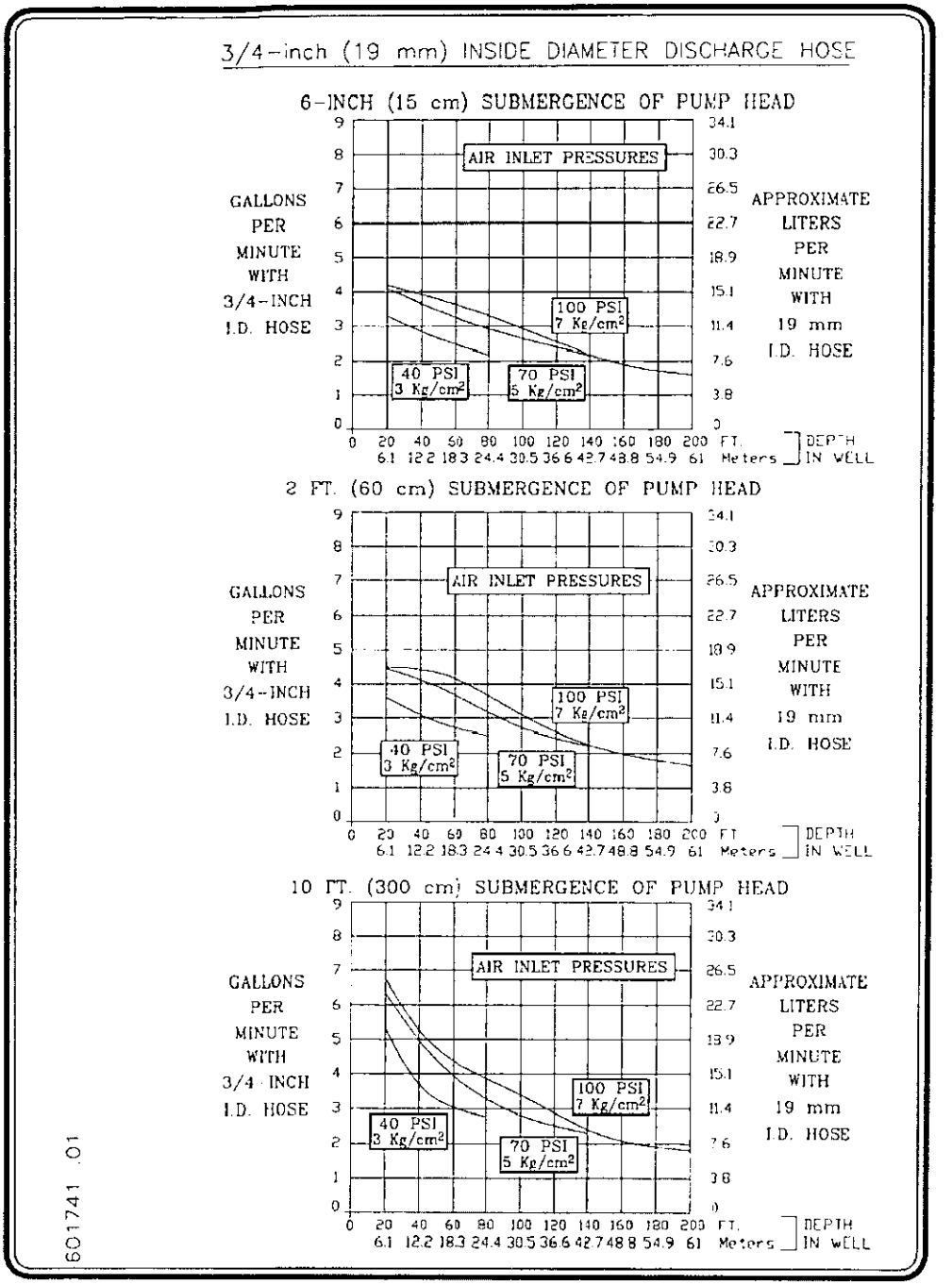


Figure 39 - Low Drawdown AP-4/BL Performance Curves: 3/4-inch (19 mm) I.D. Discharge US and METRIC UNITS

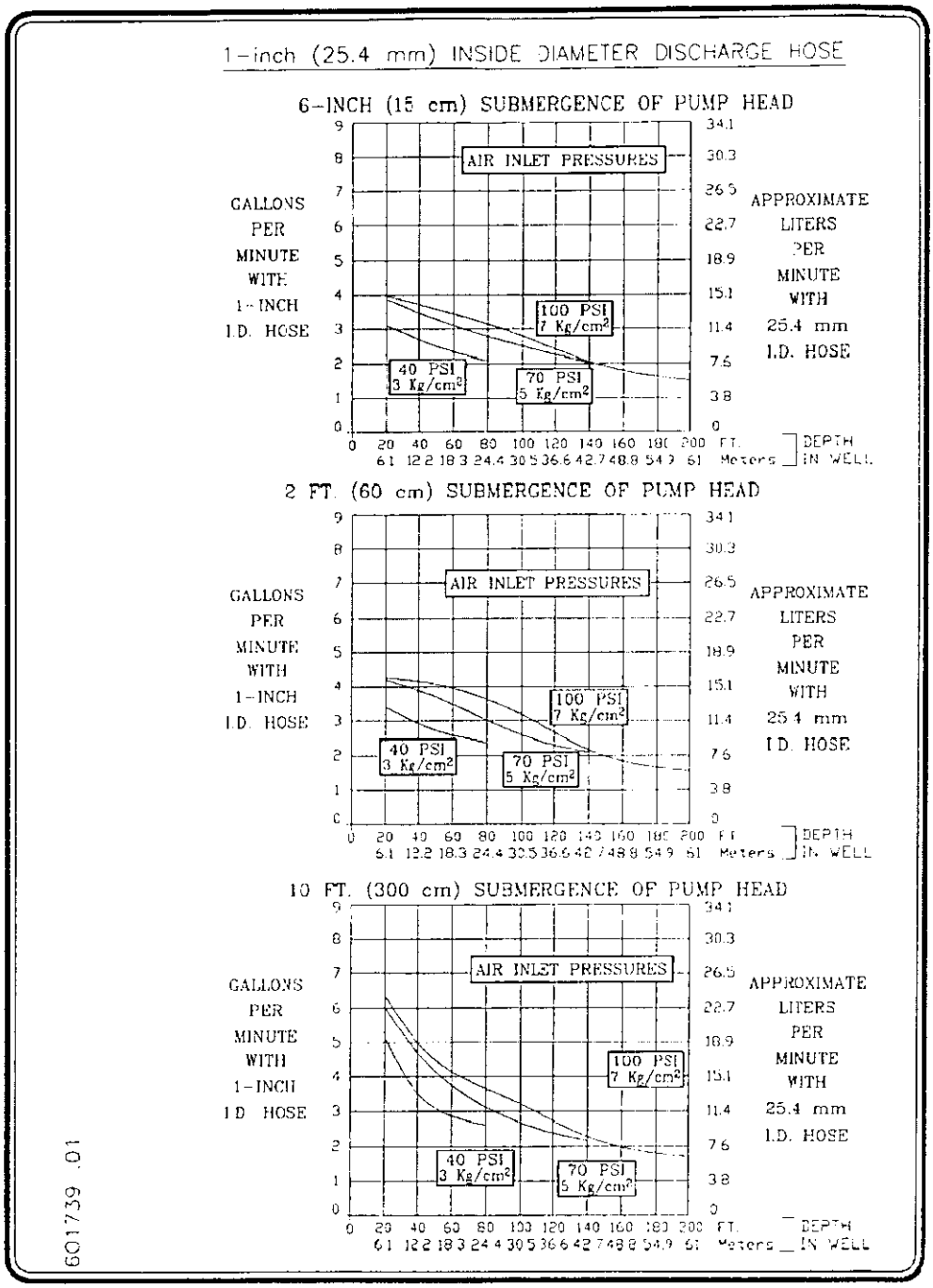


Figure 40 - Low Drawdown AP-4/TL Performance Curves: 1-inch (25.4 mm) I.D. Discharge US and METRIC UNITS

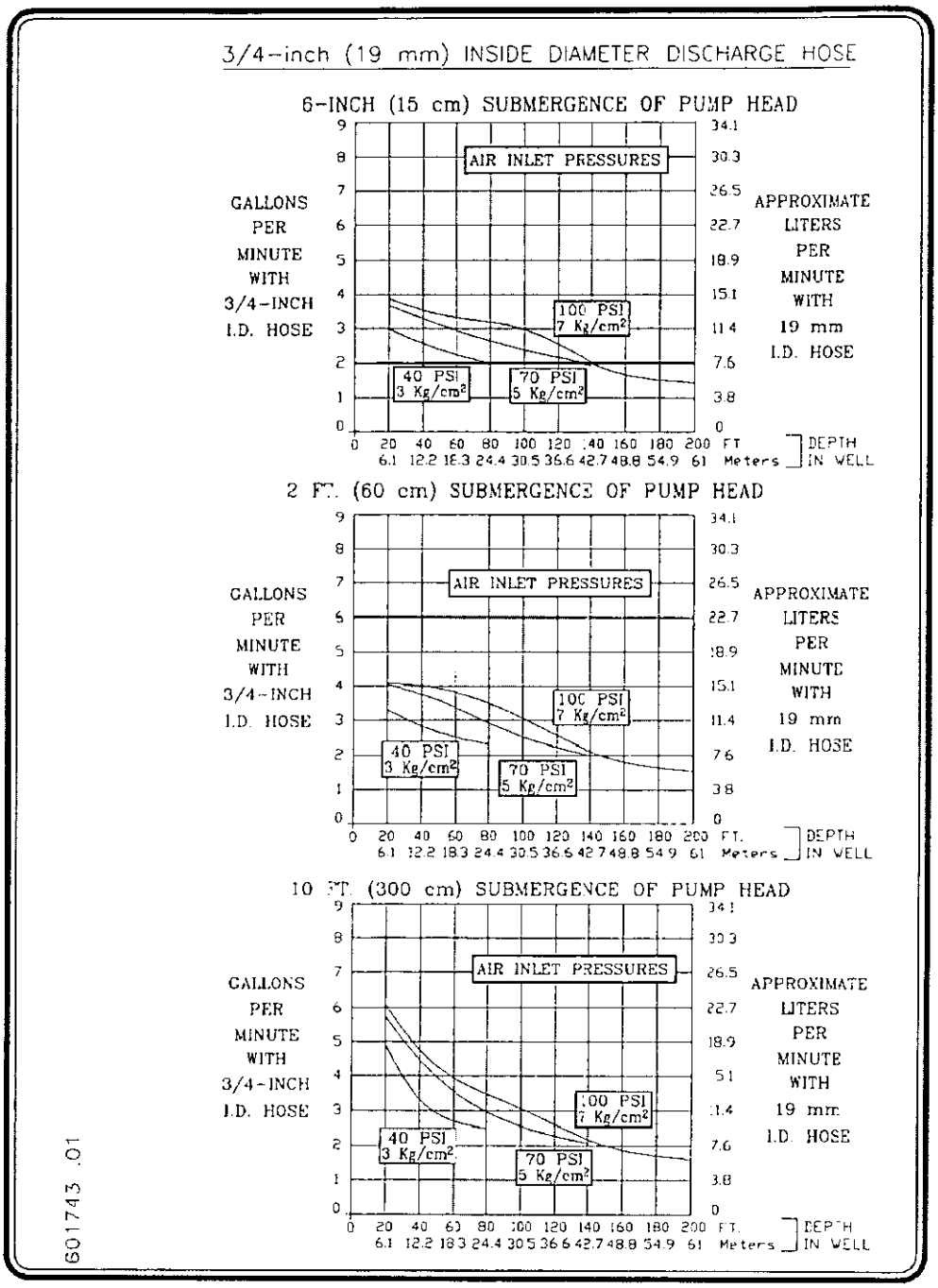


Figure 41 - Low Drawdown AP-4/TL Performance Curves: 3/4-inch (19 mm) I.D. Discharge US and METRIC UNITS

Appendix B: Air Consumption Curves

The following charts show the air consumption curves for the Long, Short, and Low-Drawdown length 3.5-inch OD AutoPumps. These curves can be used to estimate air use and compressor sizing. A compressor with reserve capacity is recommended.
(For U.S. UNITS, See Figures 42, 43, 46, 47, 50, 51, 52 and 53)
(For METRIC unit measurements, See Figures 44, 45, 48, 49, 50, 51, 52 and 53)

The curves are categorized by pump length, hose size, depth of submergence and air supply pressure. To determine the amount of air used for each gallon of fluid pumped, the following information must be known:

1. **Pump** – Long, Short, or Low Drawdown.
2. **Discharge hose size** – 3/4-inch or 1-inch is standard. A larger diameter may yield slightly lower use rates depending upon site conditions.
3. **Air pressure**.

With the above information, obtain the probable flow rate by using the following steps:

- On the horizontal scale, find the depth in the well at which the pump will be located.
- Trace that depth upwards to the line for the air inlet pressure you selected.
- Travel horizontally over to the vertical scale and read the air use factor.

Example: A long Bottom-Loading pump with a 1-inch discharge hose and 70 psi supply pressure positioned 100 feet below ground will use about .73 SCF of air for each gallon of fluid pumped.

The flow rate for the pump, taken from the flow rate curves, when there is 10 feet of fluid over the pump, is about 12.6 GPM.

Multiply the 12.6 GPM flow rate times the .73 SCF air use factor to generate a 9.2 SCFM (Standard Cubic Feet per Minute) air use result.

If the yield of the well is less than the maximum pump rate predicted by the appropriate flow rate graph, multiply the actual fluid recovery rate times the air use factor. This air use can be diminished if the regulator pressure is reduced. The maximum pump rate for the lower air pressure can be predicted using the performance curves.

Note:
These air use factors are only applicable for the designated well head conditions. Any additional resistance from out-of-well equipment (e.g. surface hoses, valves, etc.) will affect the factors shown on these curves.

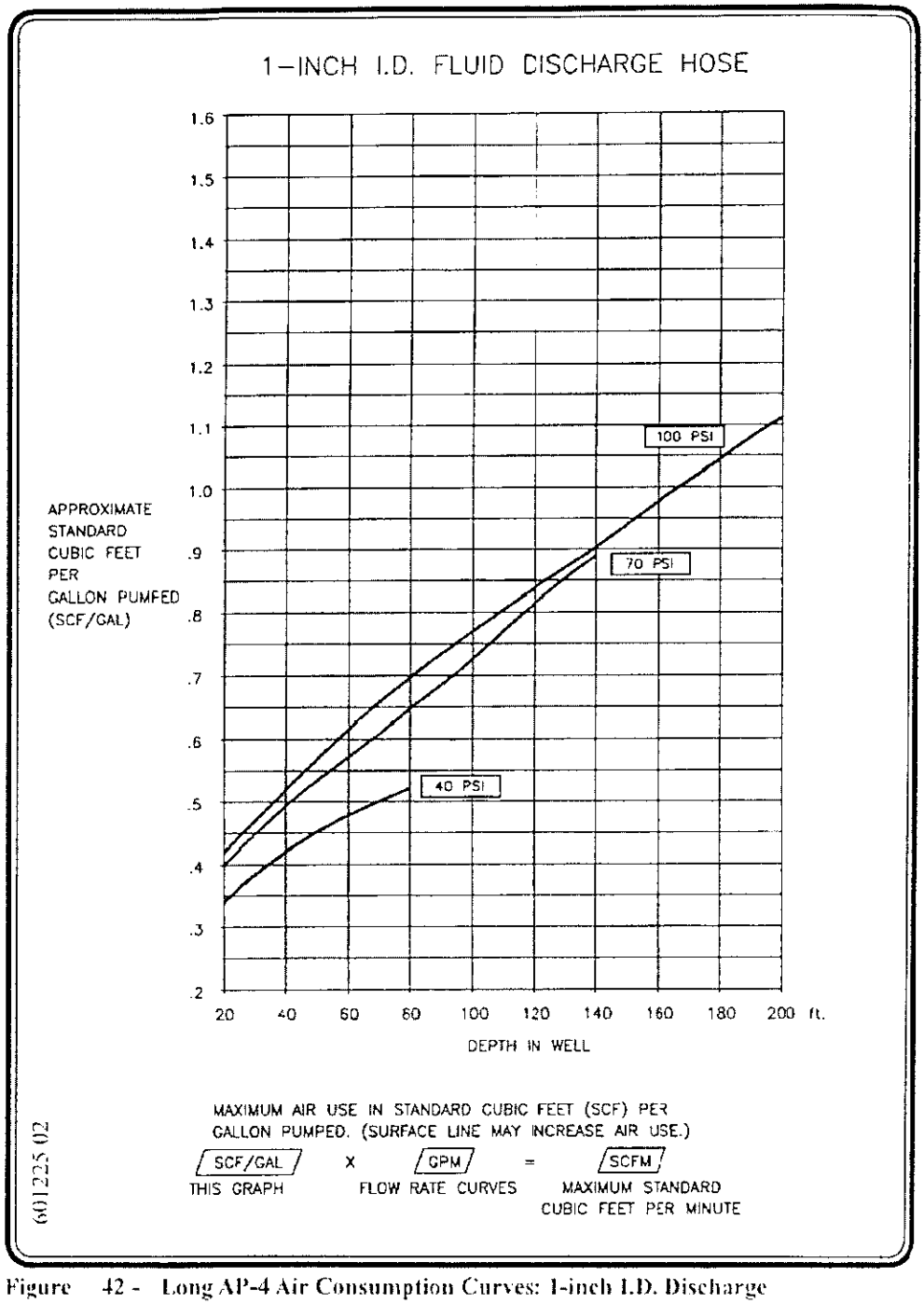


Figure 42 - Long AP-4 Air Consumption Curves: 1-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

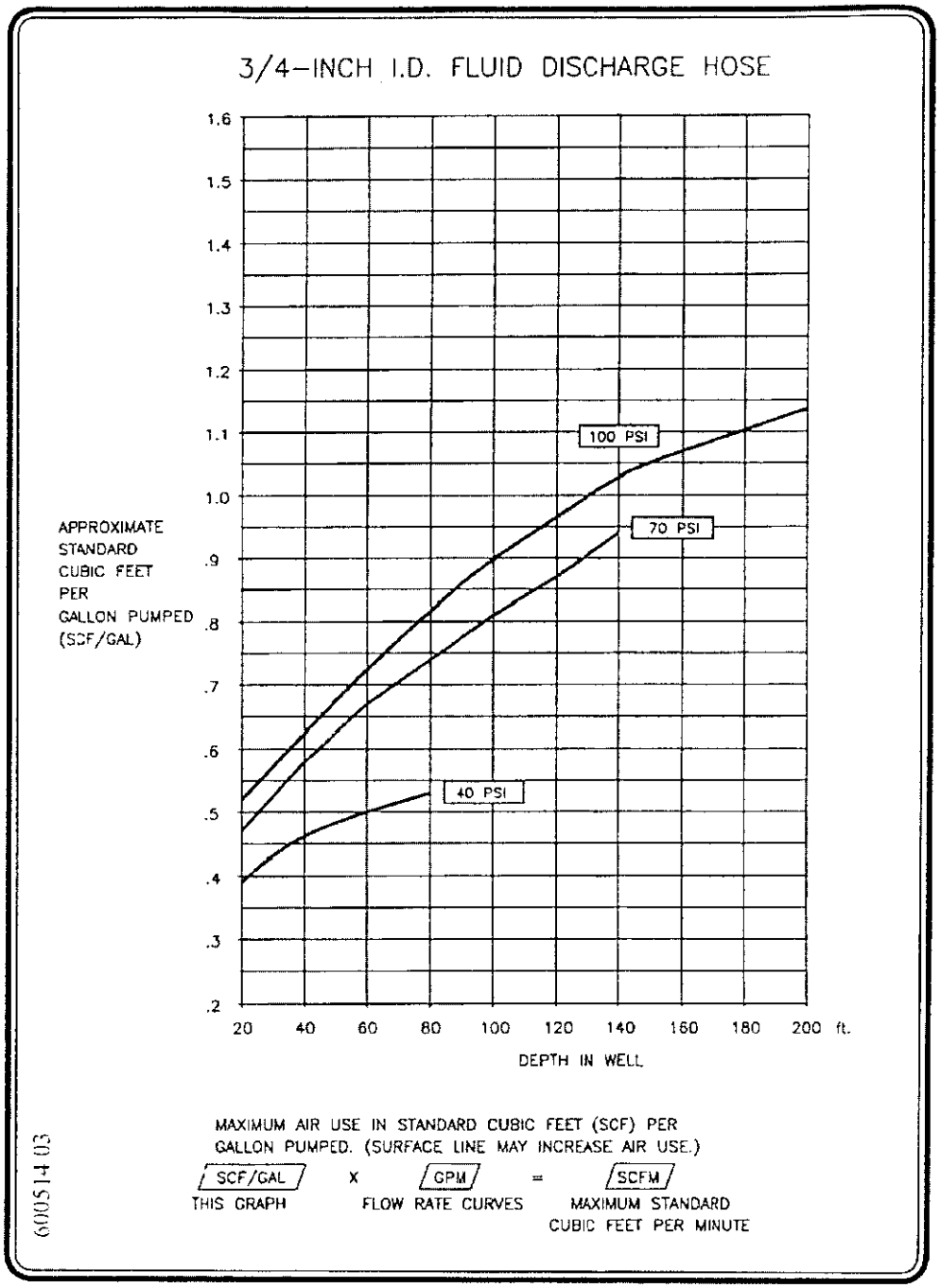


Figure 43 - Long AP-4 Air Consumption Curves: 3/4-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

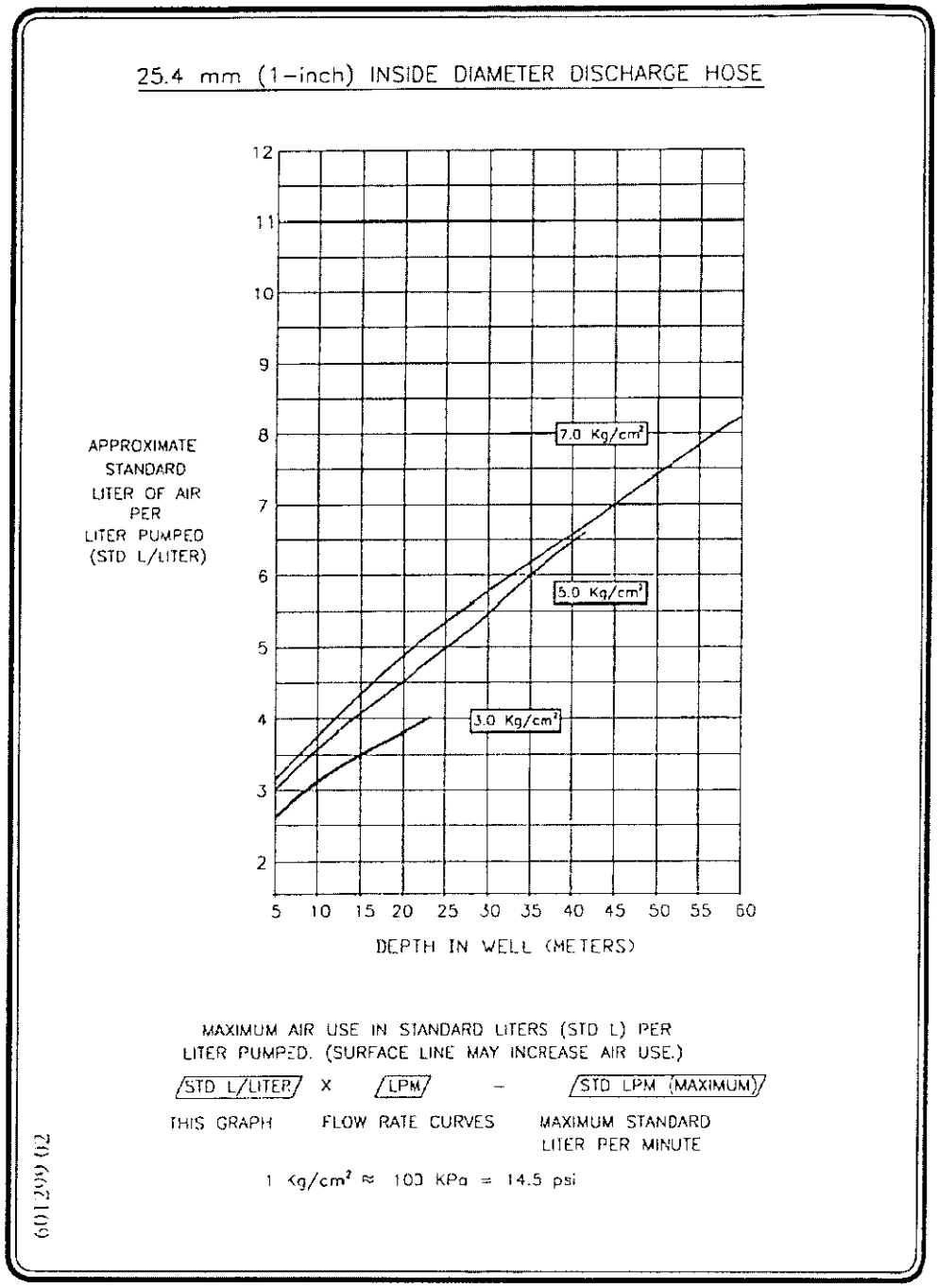


Figure 44 - Long AP-4 Air Consumption Curves: 25.4 mm (1-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

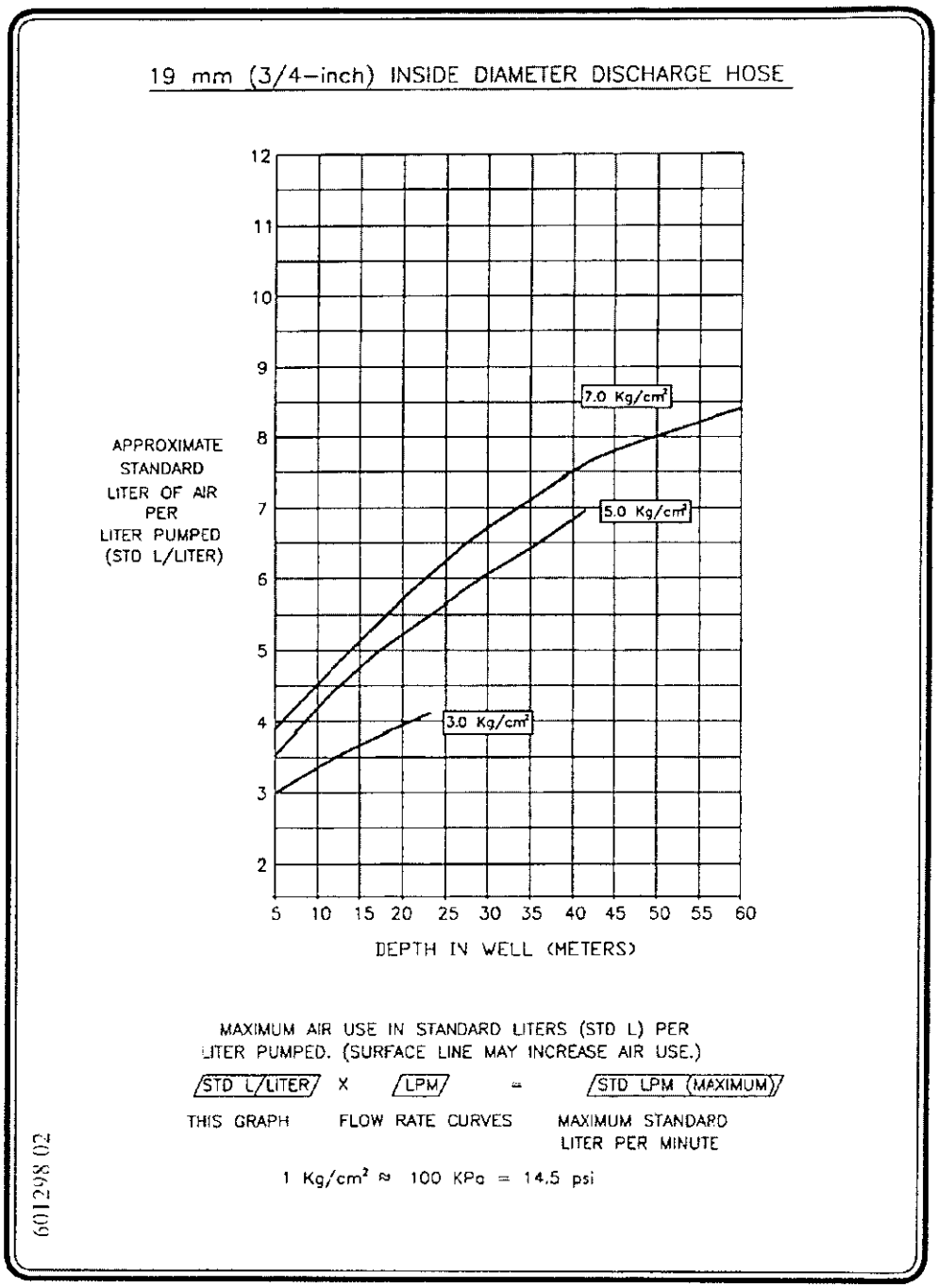


Figure 45 - Long AP-4 Air Consumption Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

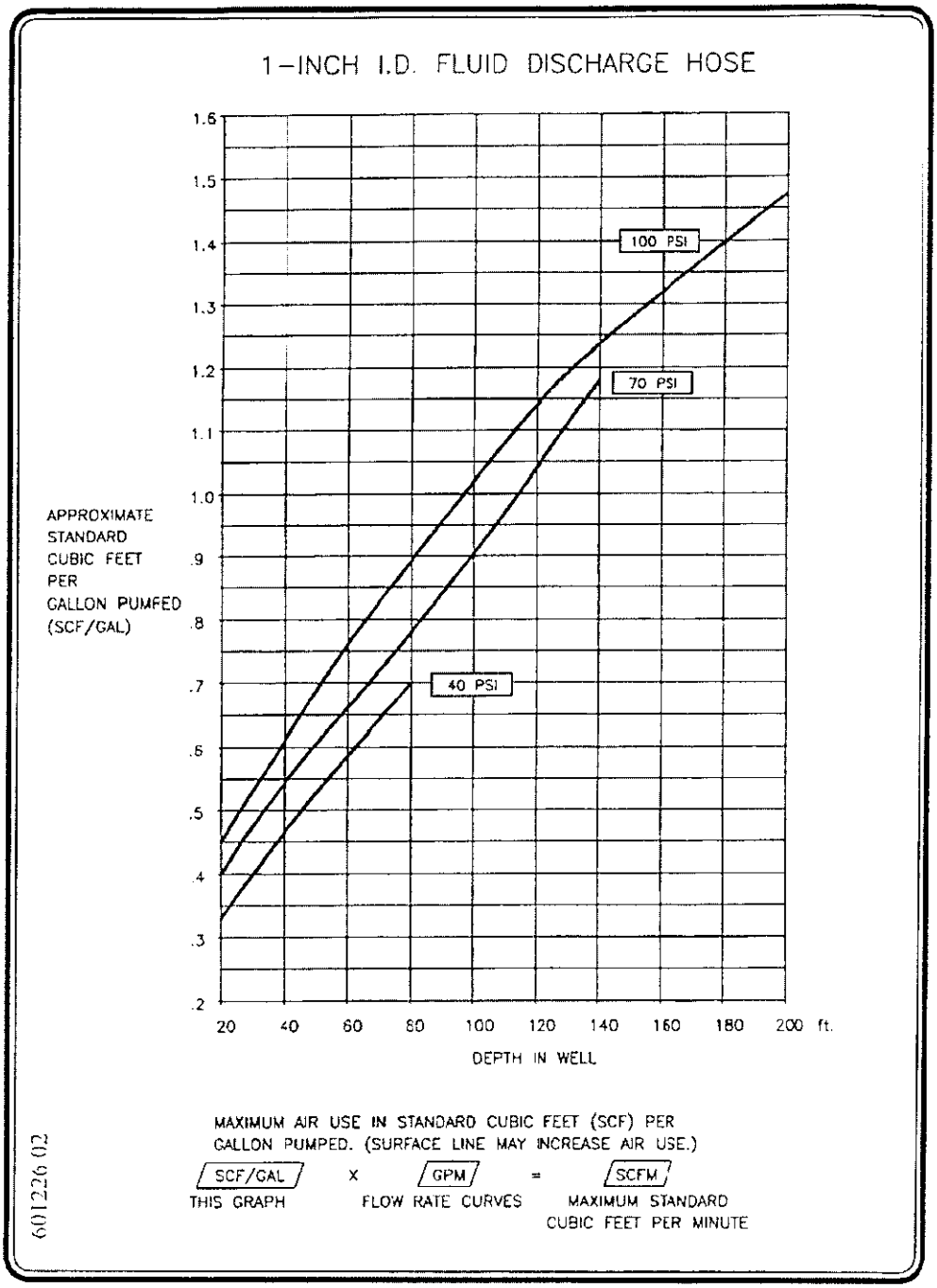


Figure 46 - Short AP-4 Air Consumption Curves: 1-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

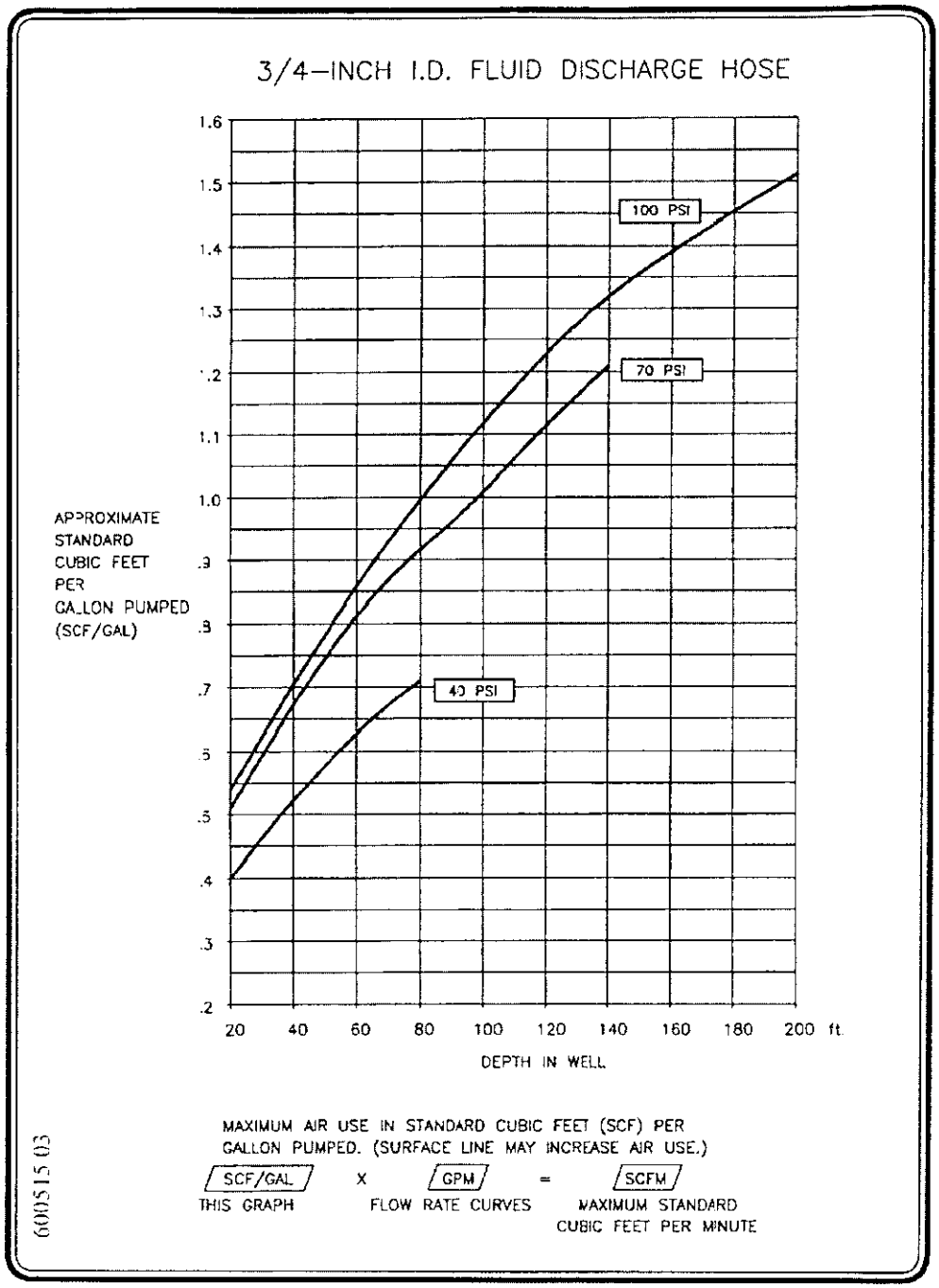


Figure 47 - Short AP-4 Air Consumption Curves: 3/4-inch I.D. Discharge U.S. UNITS (Includes Leachate Models)

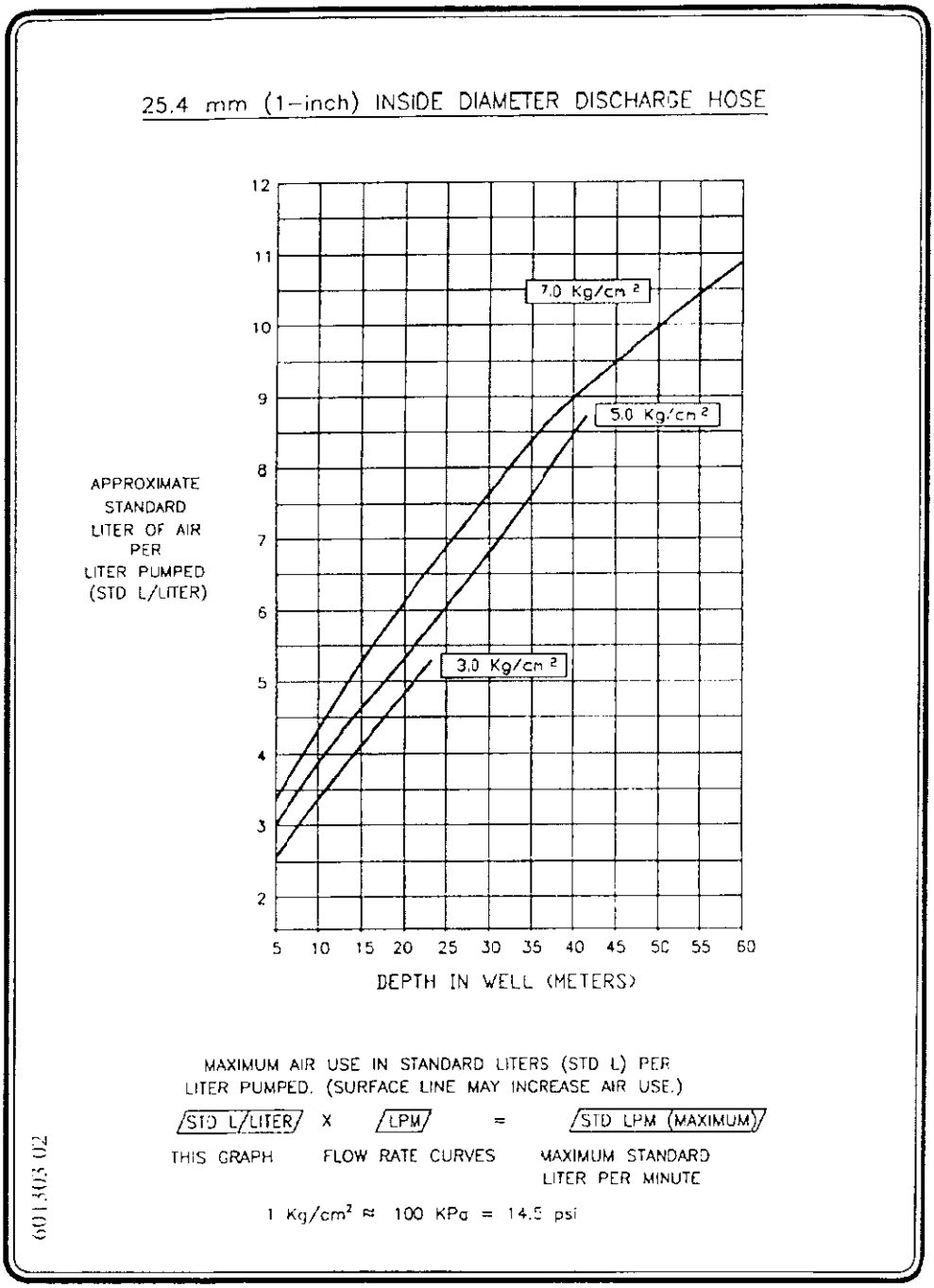


Figure 48 - Short AP-4 Air Consumption Curves: 25.4 mm (1-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

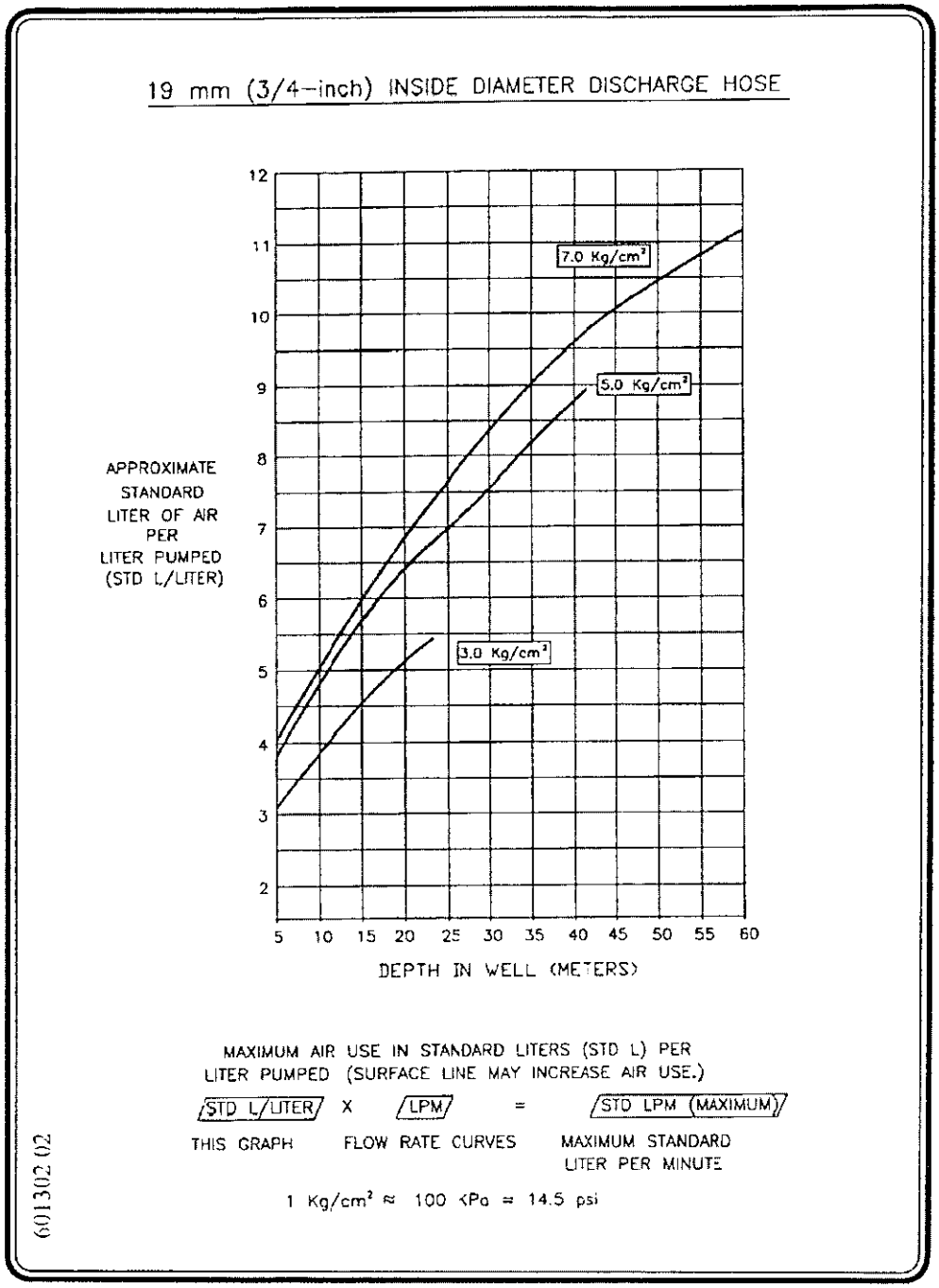


Figure 49 - Short AP-4 Air Consumption Curves: 19 mm (3/4-inch) I.D. Discharge METRIC UNITS (Includes Leachate Models)

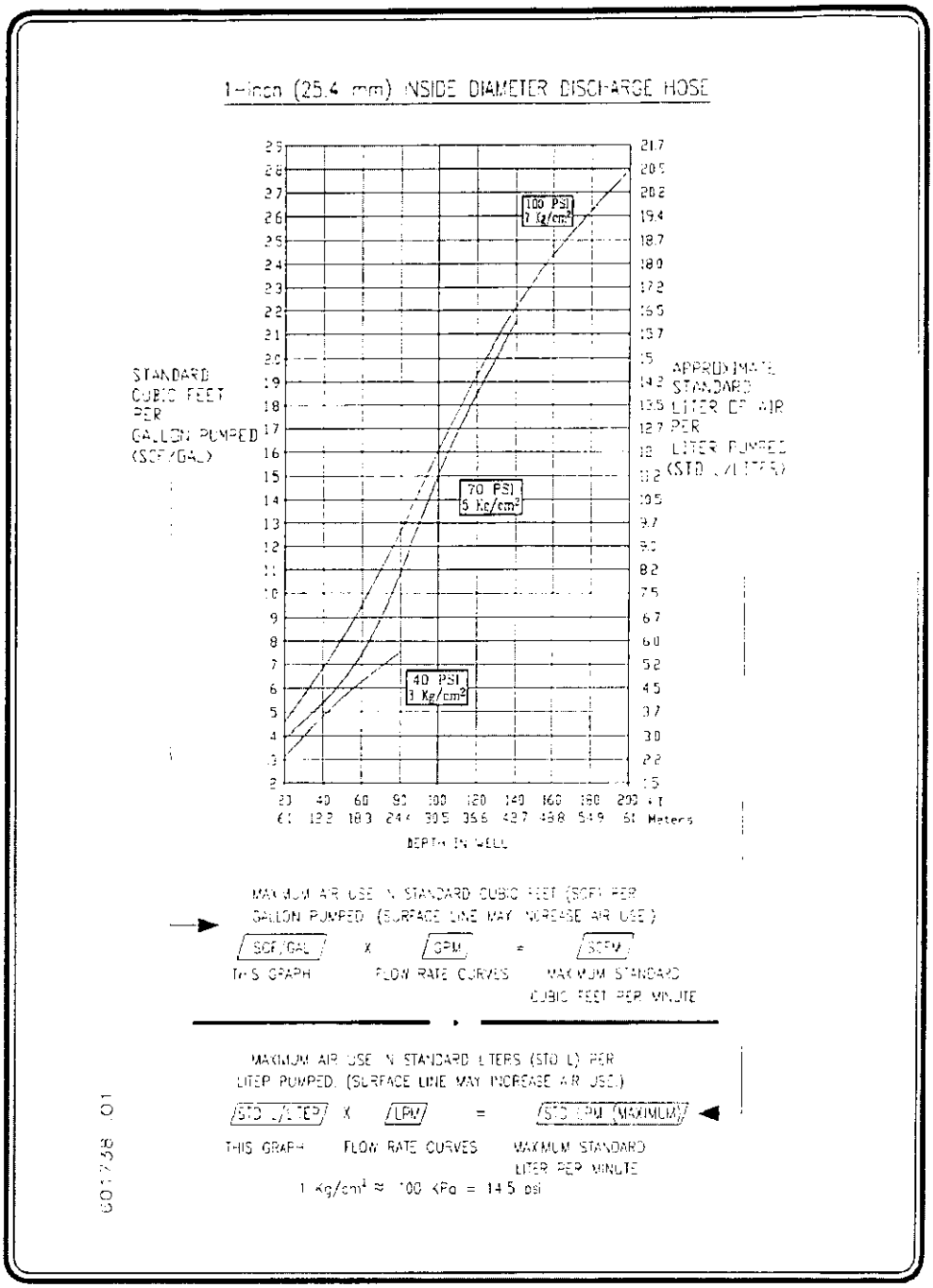


Figure 50 - Low Drawdown AP-4/BL Air Consumption Curves: 1-inch (25.4 mm) I.D. Discharge US and METRIC UNITS

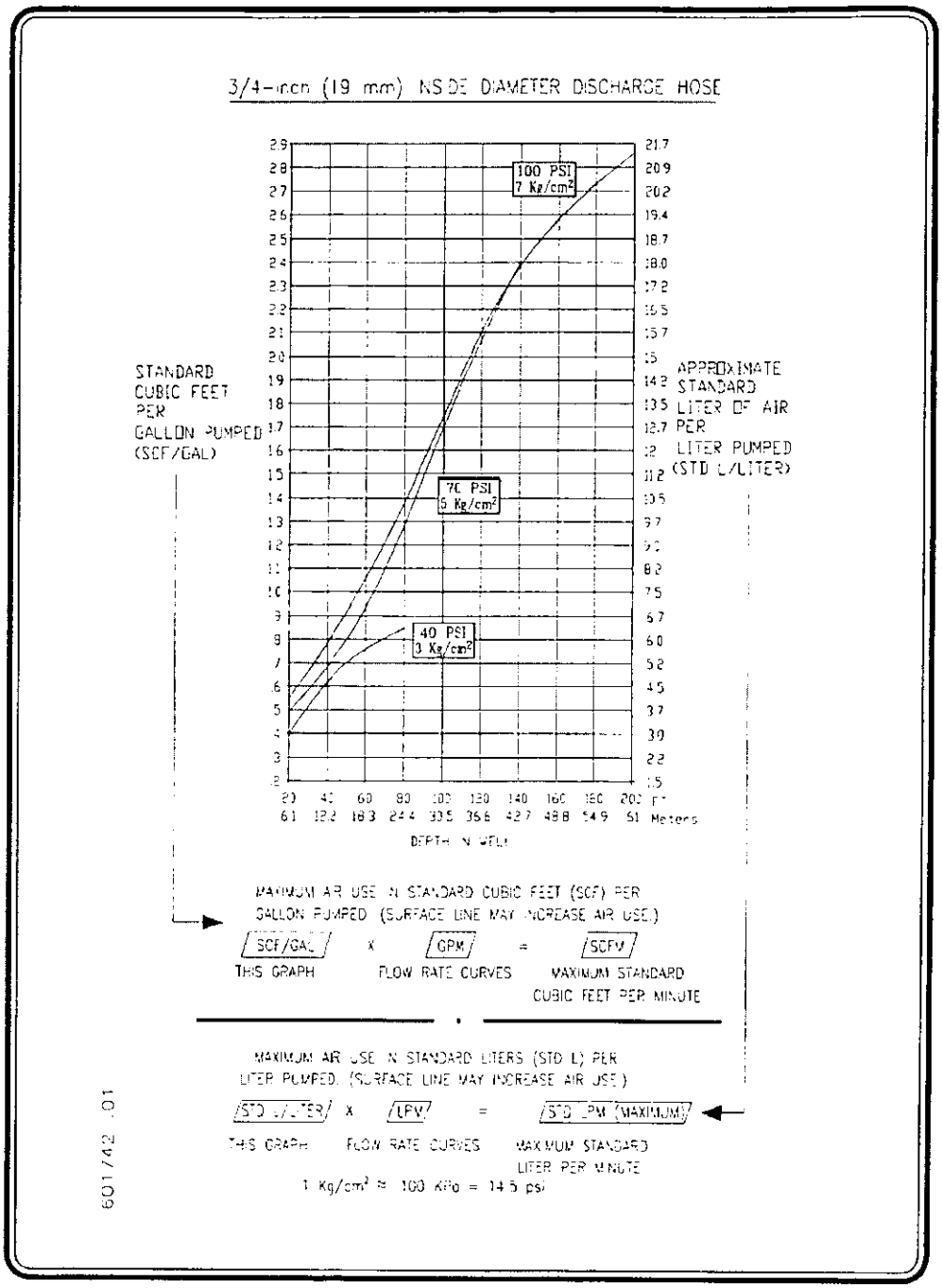


Figure 51 - Low Drawdown AP-4/BL Air Consumption Curves: 3/4-inch (19 mm) I.D. Discharge US and METRIC UNITS

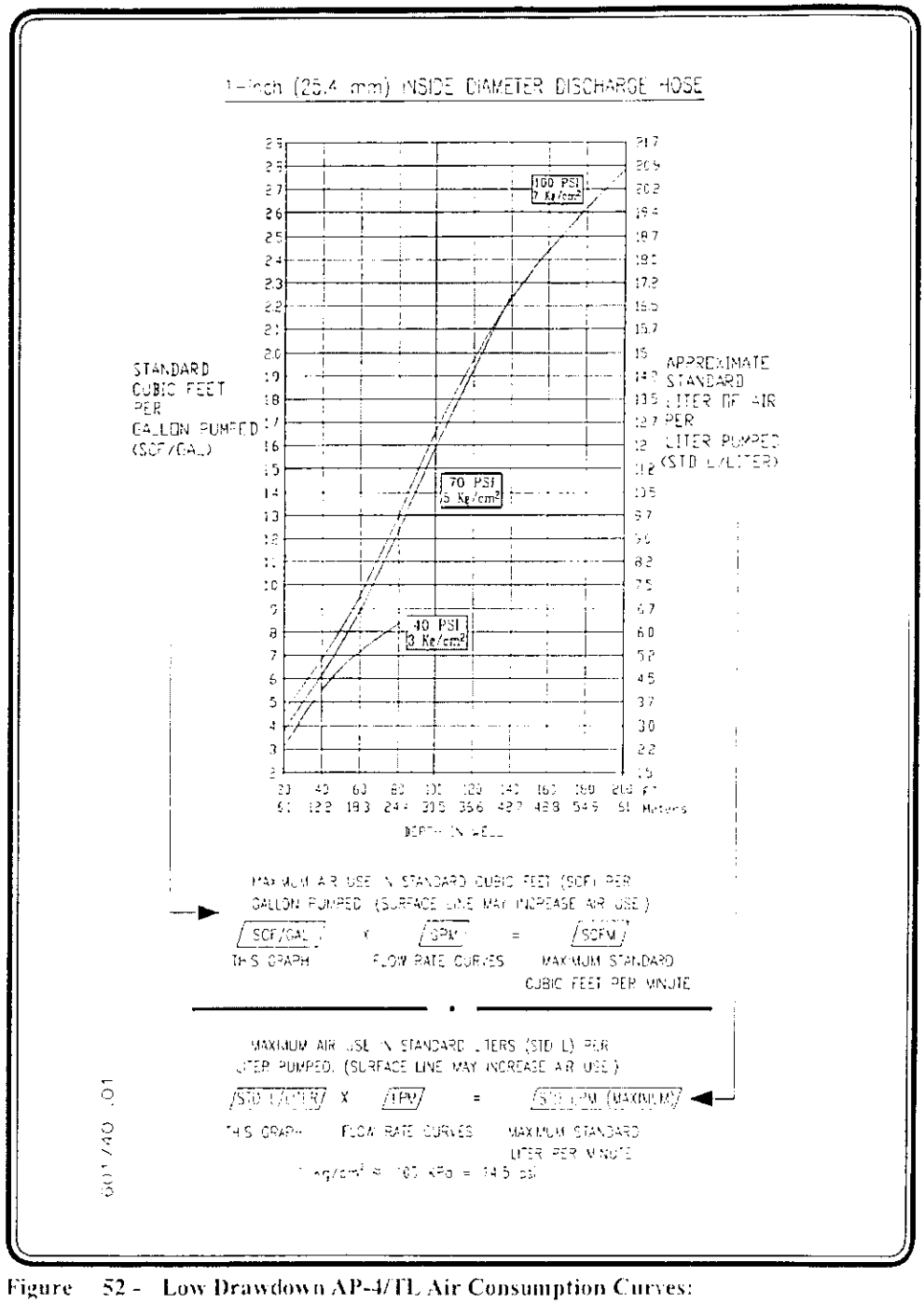


Figure 52 - Low Drawdown AP-4/TL Air Consumption Curves: 1-inch (25.4 mm) I.D. Discharge US and METRIC UNITS

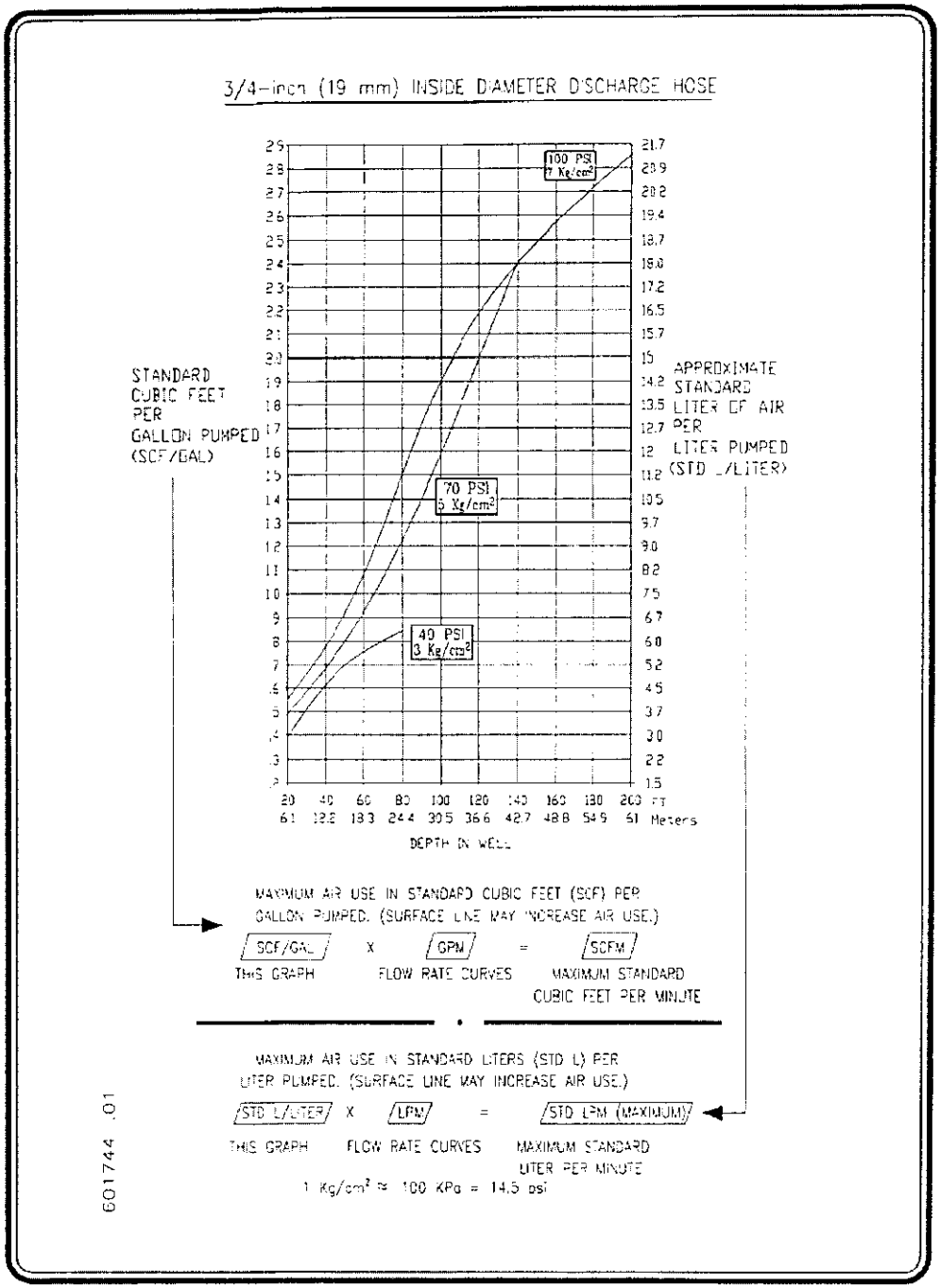


Figure 53 - Low Drawdown AP-4/TL Air Consumption Curves: 3/4-inch (19 mm) I.D. Discharge US and METRIC UNITS

Appendix C: AP-4 Conversions

The AP-4 can be converted the from Top- to Bottom-loading or Bottom- to Top-loading by rearranging the check valves.

Pumps produced prior to 1992
Top-loading to Bottom-loading conversions:

STEP 1 - Remove the inlet "Y" fitting at the top and move the inlet check valve and its inlet screen to the bottom of the pump.

STEP 2 - The outlet check valve is attached directly to the top of the export tube of the pump via a 1" coupling.

Convert a Bottom-loading pump to a Top-loading pump in the opposite manner.

Pumps produced in 1992 and after
Top-loading to a Bottom-loading conversion:

STEP 1 - Remove the inlet "Y" fitting at the top and install the outlet check valve in a coupling to the top of the export tube at the top of the pump. The inlet check valve must be obtained from *QED*.

STEP 2 - This inlet check valve replaces the blanked fitting at the bottom of a Top-loading pump.

Convert a Bottom-loading pump to a Top-loading pump in the opposite manner.
(See Figure 54 and 55)

> **Note:**
> When changing short pumps, change the outer casing as well. The casing for the short Top-loading pump is about 3 inches shorter than the case for long Top-loading pump.

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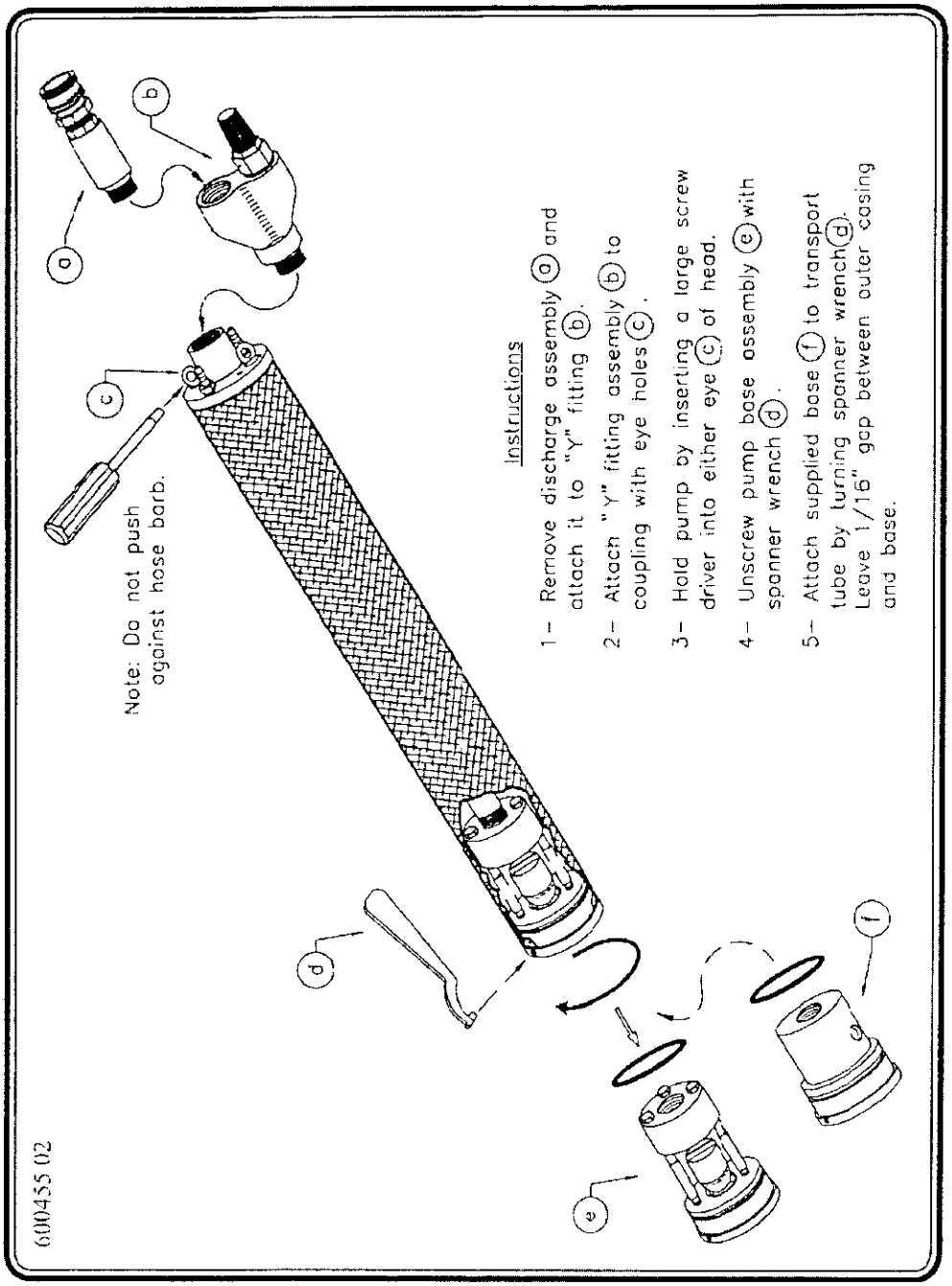


Figure 54 - Conversion From Bottom-Loading to Top-Loading AutoPump for pumps made after 1991

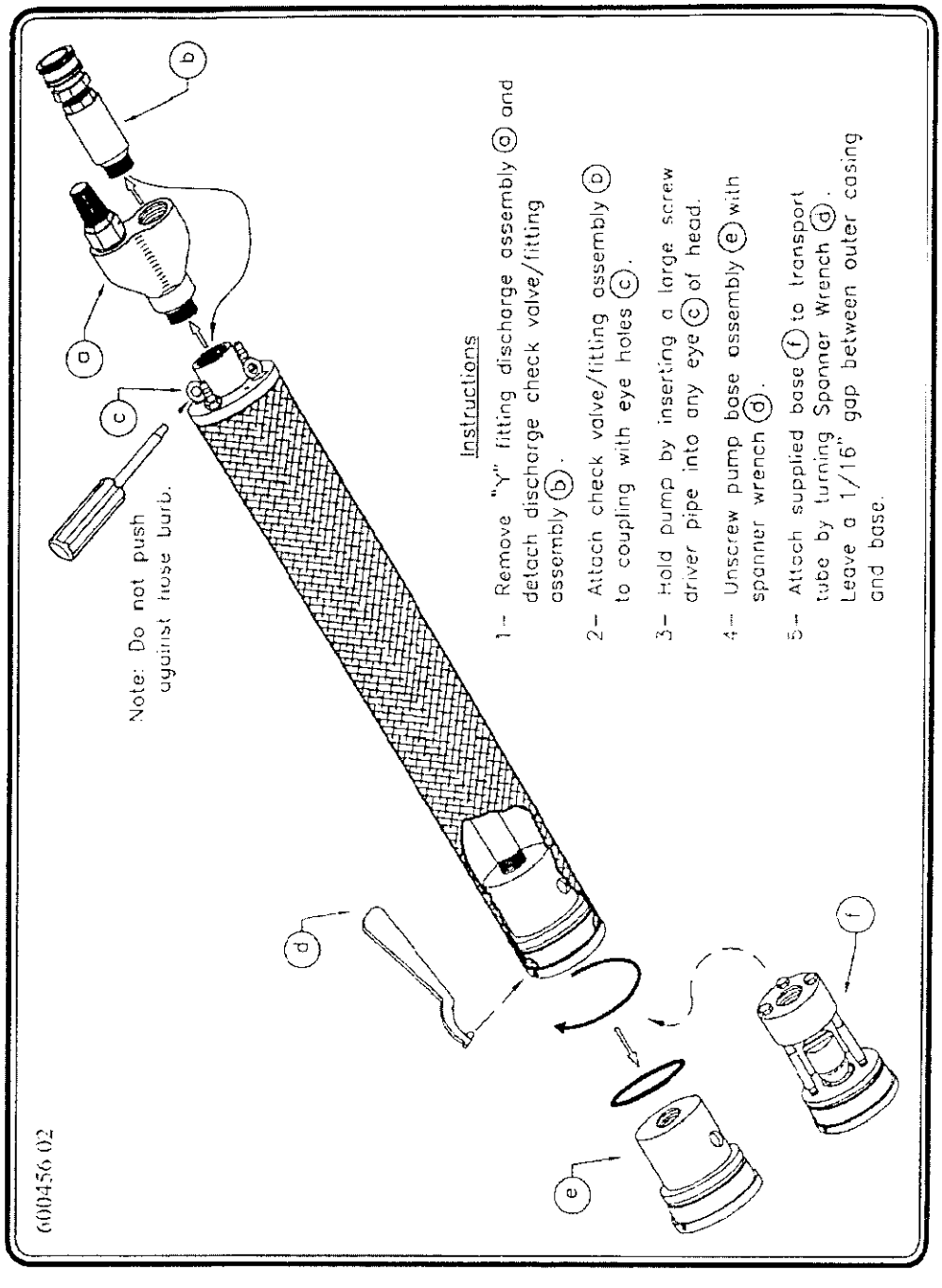
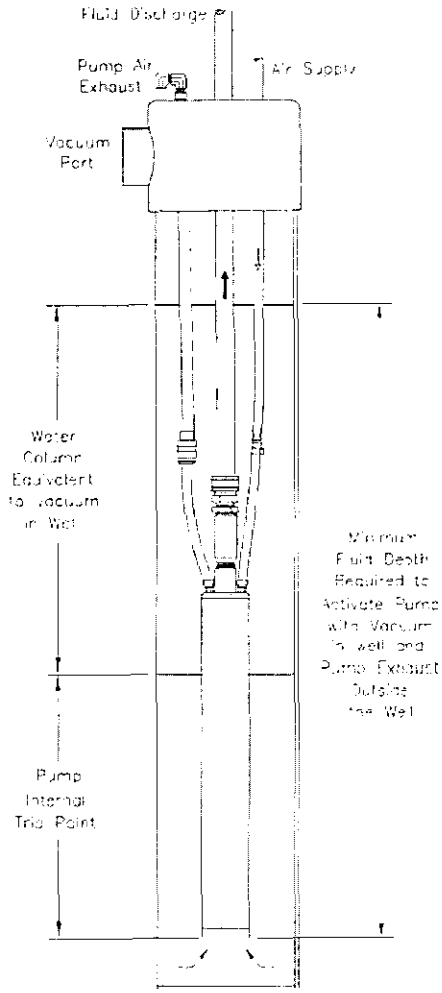


Figure 55 - Conversion From Top-Loading to Bottom-Loading AutoPump for pumps made after 1991

Appendix D: Vacuum on Well

The AP-4 will work in a well that is under vacuum, but there are several conditions that must be considered. These conditions are described in **Figure 56, Figure 57, Figure 58, and Figure 59** on the following pages.



- The water level required to activate the pump is equal to the pump internal trip point plus the vacuum water column.

  Example:

  - A Short AP-3/BL has an internal trip point of 22 in.
  - A well vacuum of 30 in. W.C. (water column)

  22+30 = 52 in.
  Water depth required to activate pump

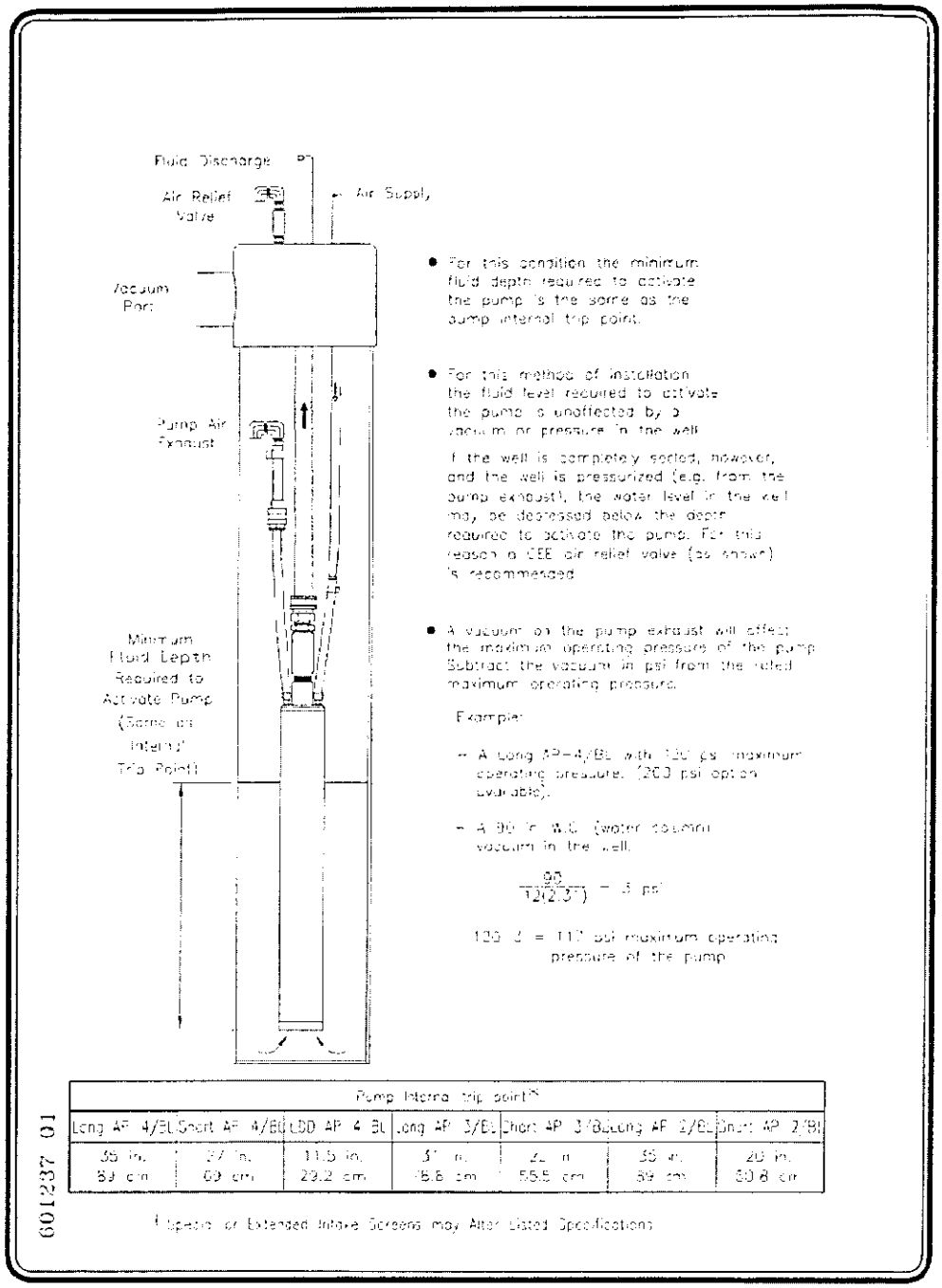
- The rated maximum operating pressure of the pump is not affected by this method of installation.

Pump Internal trip point*						
Long AP-4/BL	Short AP-4/BL	LOD AP-4/BL	Long AP-3/BL	Short AP-3/BL	Long AP-2/BL	Short AP-2/BL
35 in. 89 cm	27 in. 69 cm	7.5 in. 19.1 cm	31 in. 78.8 cm	22 in 55.5 cm	35 in. 89 cm	20 in. 50.9 cm

*Special or Extended Intake Screens may Alter Listed Specifications

601238 01

Figure 56 - AP-4/BL with Vacuum In the Well and Pump Exhaust Outside the Well

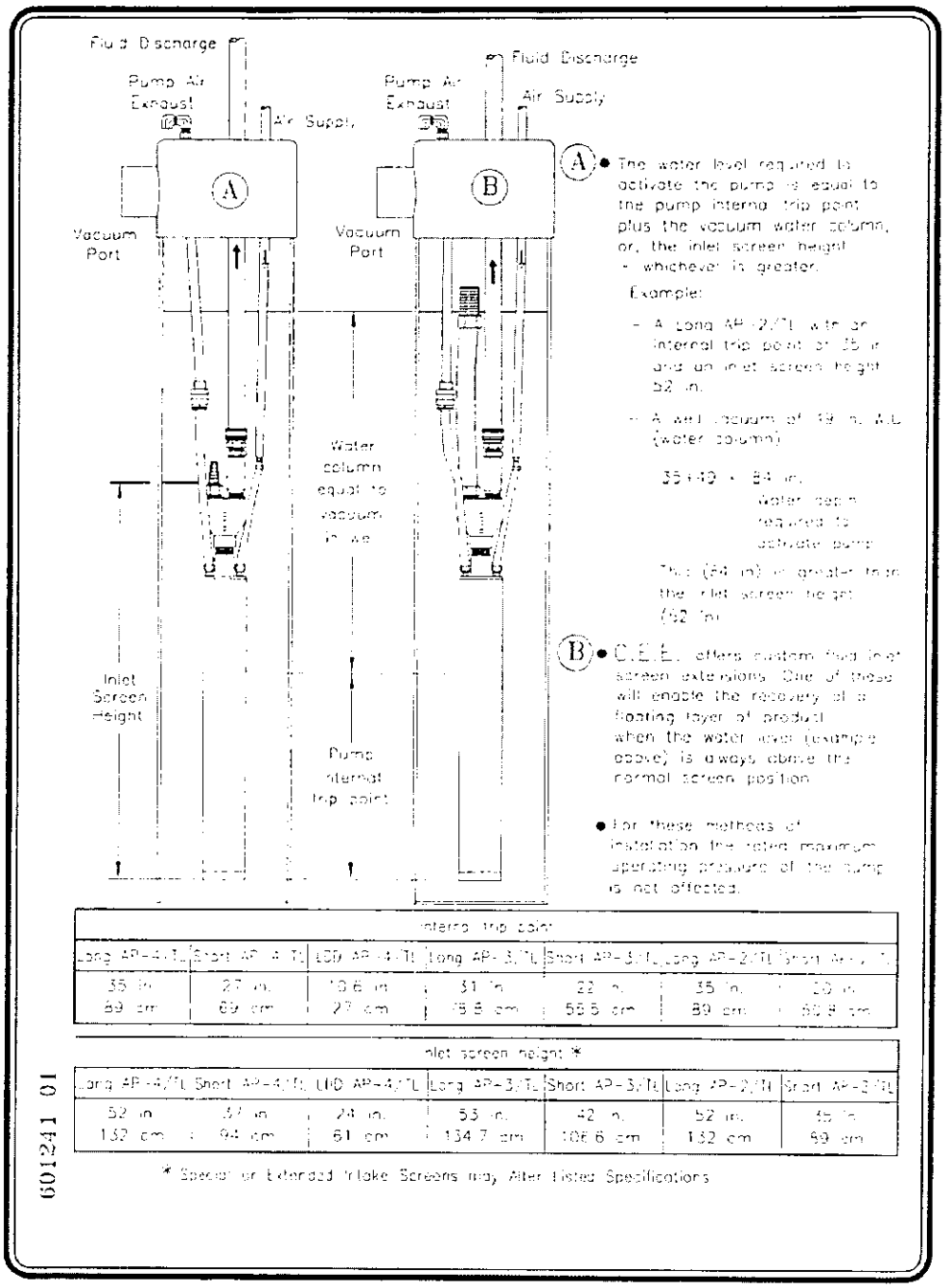


Pump Internal trip point*						
Long AP-4/BL	Short AP-4/BL	LSD AP-4/BL	Long AP-3/BL	Short AP-3/BL	Long AP-2/BL	Short AP-2/BL
55 in. 89 cm	37 in. 69 cm	11.5 in. 29.2 cm	31 in. 78.8 cm	22 in. 55.5 cm	55 in. 89 cm	20 in. 50.8 cm

* Special or Extended Intake Screens may Alter Listed Specifications

601237 01

Figure 57 - AP-4/BL with Vacuum In the Well and Pump Exhaust In the Well



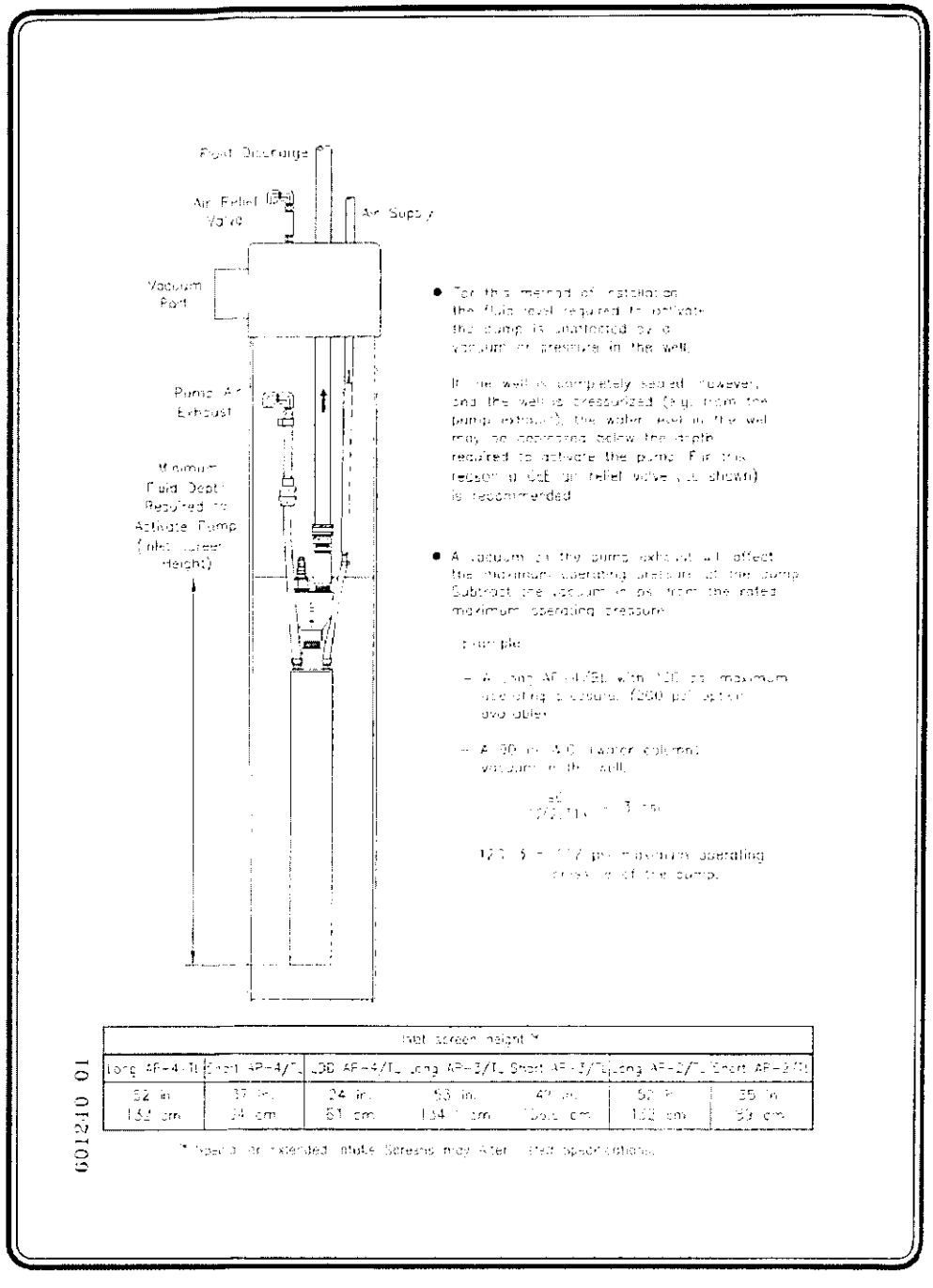
Internal trip point						
Long AP-4/TL	Short AP-4/TL	LDO AP-4/TL	Long AP-3/TL	Short AP-3/TL	Long AP-2/TL	Short AP-2/TL
35 in 89 cm	27 in. 69 cm	10.6 in 27 cm	31 in 78.8 cm	22 in. 55.8 cm	35 in. 89 cm	26 in. 66.8 cm

Inlet screen height *						
Long AP-4/TL	Short AP-4/TL	LDO AP-4/TL	Long AP-3/TL	Short AP-3/TL	Long AP-2/TL	Short AP-2/TL
52 in 132 cm	37 in 94 cm	24 in. 61 cm	53 in. 134.7 cm	42 in. 106.6 cm	52 in. 132 cm	45 in. 99 cm

* Special or Extended Intake Screens may Alter Listed Specifications

601241 01

Figure 58 - AP-4/TL with Vacuum In the Well and Pump Exhaust Outside the Well



Inlet screen height *						
Long AP-4/TL	Short AP-4/TL	LOB AP-4/TL Long	AP-3/TL Short	AP-3/TL Long	AP-2/TL Short	AP-2/TL
82 in. 152 cm	37 in. 94 cm	24 in. 61 cm	53 in. 134 cm	49 in. 124 cm	50 in. 122 cm	35 in. 89 cm

* Typical or extended intake Screens may alter inlet specifications.

Figure 59 - AP-4/TL with Vacuum In the Well and Pump Exhaust In the Well

Appendix E: Air Compressor

Installation

The air compressor provides the air necessary to drive the system. The compressed air normally passes through a single stage filter/regulator and then into the AutoPump System.

WARNING:
The air compressor and any other electrical equipment used with this pneumatic system must be positioned outside of any area considered hazardous because of the possibility of the presence of combustible materials.

Compressors start and stop automatically. Do not place hands or objects on or near any part of the compressor.

QED Environmental Systems (QED) does not usually supply the air compressor. It is best to buy the compressor from a local supplier who provides service. Follow the instructions that accompany the compressor. This appendix is only a general guide, not an in-depth manual for the compressor.

WARNING:
When compressing air, parts of a compressor can get very hot. Do not touch the motor, compressor or piping until it has cooled down.

Caution:
The air compressor should be located outside and away from any area which may contain flammable fumes.

Note:
An automatic drain on the compressor receiver tank significantly reduces the load on the air filters, extends the life of the filter elements, and reduces system maintenance. If your air compressor is not equipped with an automatic drain, you can obtain one from QED.

Note:
The information on compressors is for reciprocating piston compressors. A centrifugal compressor produces about twice the air of a piston compressor for the same horsepower.

- As a general rule, a piston-type compressor should not start more than six times per hour. Also, a piston compressor should not operate more than 50% of the time.
- At a minimum, the air compressor should be in the 1 to 1-1/2 HP range with a 20 gallon holding tank.
- At sea level a 1 HP air compressor provides approximately 3.5 cubic feet per minute (SCFM) of free air.
- For compressor sizing, all down well and surface hosing and other resistance must be known.
- The 2 and 3 HP compressors should have 60 to 80 gallon tanks.
- A 5 HP compressor should have at least an 80 gallon tank, and the 7-1/2 HP and 10 HP compressors should have at least a 120 gallon tank.
- Storage tanks and automatic pressure shut-off switches provide a buffer so the compressor motor can cool between each time the tank is pressurized.
- Compressors are generally equipped with a pressure activated start/stop switch. This switch senses the pressure of the air in the holding tank (reservoir) of the compressor. The pressure difference between when the compressor starts and when it stops may need to be adjusted to maintain compressor starts to six times per hour. Refer to the compressor manufacturer for guidance.

Electrical Wiring for the Compressor

- All electrical connections should be made by a licensed electrician and in accordance with the electrical code for particular areas. The wiring should provide full motor nameplate voltage and current at the motor terminals during start-up.
- Wiring hookup must be made so that the compressor flywheel turns in the proper direction. There is usually an arrow on the flywheel to indicate the proper rotation direction.

Motor Overload Protection

- To prevent motor damage, provide all compressor motors with overload protection. Some motors are furnished with built-in thermal overload protection.

- To prevent motor damage due to low voltage or undue load imposed on the motor, use larger motors in conjunction with starters that include thermal overload units.

- To determine the proper thermal protection (thermal element), consider the load to be carried, the starting current, the running current, and the ambient temperature. Recheck electric current characteristics against nameplate characteristics before connecting wiring.

> **Caution:**
> Fuses are for circuit protection only and are not to be considered motor protection devices. Consult your local power company regarding proper fuse size.

Air Quality and Pressure

- In compressors requiring lubricating oil, do not use synthetic oil. Synthetic oil can adversely affect some materials. Non-detergent 30 Weight oil is recommended for compressor lubrication.

- Install an automatic drain on the compressor holding tank to periodically drain the water and oil which collects in the tank. This will help to extend air filter cartridge life.

- Do not lubricate the compressed air coming out of the compressor. QED equipment is designed to run without the aid of lubricated air. The air filters are designed to remove oil from the compressed air.

- The compressor should provide between 70 and 250 pounds per square inch (psi) of air pressure to the system. The filter (with metal bowl) and regulator will accept a maximum of 250 psi air pressure. Air filters with plastic bowls will accept a maximum of 150 psi. Maximum output air pressure setting on the regulator is 120 psi.

Maintenance

Although QED usually does not supply the compressor, this section is provided to help the operator. If the system receives clean, oil-free air from the compressor, maintenance will be significantly reduced.

Inspection - Check for possible damage in transit. Almost all compressors are shipped with the flywheel unmounted. Do not force the flywheel on the crankshaft. Use a wedge-in "slot" provided for easy assembly. Checked belt alignment and tension carefully.

Placement - A compressor is a source of sparking. Place it out of what is considered a hazardous area by local and national fire and electric codes

Mounting - Install in a clean, dry, well-ventilated location away from any source of heat such as a boiler or radiator. If the unit is to be fastened to a foundation, support and shim all four feet firmly to remove all stress from the unit. The compressor flywheel should be mounted towards a wall with a minimum clearance of 18 inches to allow for circulation of air and additional clearance if required for servicing.

Lubrication - Fill the crankcase to the level mark on the oil gauge. Use the type of industrial compressor oil that is recommended by the manufacturer for the ambient temperature. Do not use synthetic oil, as these can damage the pumps.

Pressure and Speed - Never operate the compressor at pressures or speeds in excess of those recommended by the factory. Every compressor assembly must have a safety valve installed and should be set at either the maximum tank working pressure or 25 ps. over the actual pressure of the pump, whichever is less.

Daily - Check for unusual noise, failure to compress, overheating, oil leaks, and vibration. Correct before serious damage can develop. Drain all condensate from receiver and traps.

Weekly - Examine intake filter elements and if they are dirty, remove and clean or replace them. Check oil level and add oil if necessary. Do not fill over level mark on sight glass. Keep compressor clean for efficient operation and appearance.

Monthly - Check and tighten all bolts and nuts as required. Check air connections for air leaks and tighten as required. Check belt tension.

Note:
These are standard maintenance procedures which the QED Environmental Systems "warranty" does not cover. QED does not manufacture compressors. Always use the manufacturer's instructions and recommendations when installing, using and servicing the compressor. These notes are included as a general guide only.

Troubleshooting

Although QED usually does not supply the compressor, this section is provided to help the operator. If the system receives clean, oil-free air from the compressor, maintenance will be significantly reduced.

I. Problem: Slow Pumping or Insufficient Pressure

Solutions:
A. Clogged filter element: clean or replace.

B. Leaks in air lines: retighten or replace.

C. Insufficient air capacity: add compressor capacity, consult dealer.

D. Head valves: clean or replace.

E. Slipping belts: adjust or replace.

F. Power cord is too long for the power needed, causing a voltage drop: use a short cord with large wires. Do not coil the power cord.

II. Problem: Excessive Oil Consumption

Solutions:
A. Too much oil: drain out excess to level mark on sight glass.

B. Worn rings: replace rings.

C. Clogged air intake filters: clean or replace.

D. Improper Oil: check the manufacturer's recommendation.

E. Oil leaks: check and tighten all bolts and nuts to manufacturer's specifications. Replace gaskets if necessary.

F. See "Overheating."

III. Problem: Overheating

Solutions:

A. Pump running backwards: reverse rotation.

B. Inadequate ventilation or high ambient temperature: move intakes to outside and install filters to protect against weather and foreign objects. Force air through enclosure if necessary.

C. Restricted air intakes: clean or replace.

D. Loose or restricted valves: retighten, clean, or replace.

E. Incorrect installation: allow 18 inches minimum between wall and flywheel.

F. Insufficient air capacity: consult dealer. Seal all air leaks.

G. Insufficient oil: check level and consult dealer.

IV. Problem: Oil or Water in Air

Solutions:

A. Drain tank more often: use an automatic drain.

B. Reposition intake to take in cooler, drier air.

C. Install water dropouts with automatic drains in the air lines.

D. Install an after cooler prior to the air storage tanks.

Appendix F: Pump Cycle Counter

Introduction

QED Environmental Systems (QED) Pump Cycle Counters (PCC) are air pulse detecting units that are placed in-line between a pump and its air supply. They require no external power source. A digital readout displays the number of times a pump cycles. PCC's consist of a magnet housing, an internally located magnet shuttle, and a digital display.

The position of the digital display is adjustable, allowing the counter to be used on many different kinds of pumps and at various distances from the well. **(See Figure 60)**

The PCC can be used on at least 150 feet (45.7 m) of 3/8 inch (9.5mm) or 1/4 inch (6.4mm) air hose with air pressure supply 30% higher than the total developed head.

Performance of the PCC is dependent upon the air hose size and the length, the type of pump and the system pressure. Air flow control valves can affect counter performance. Please contact *QED* for application assistance.

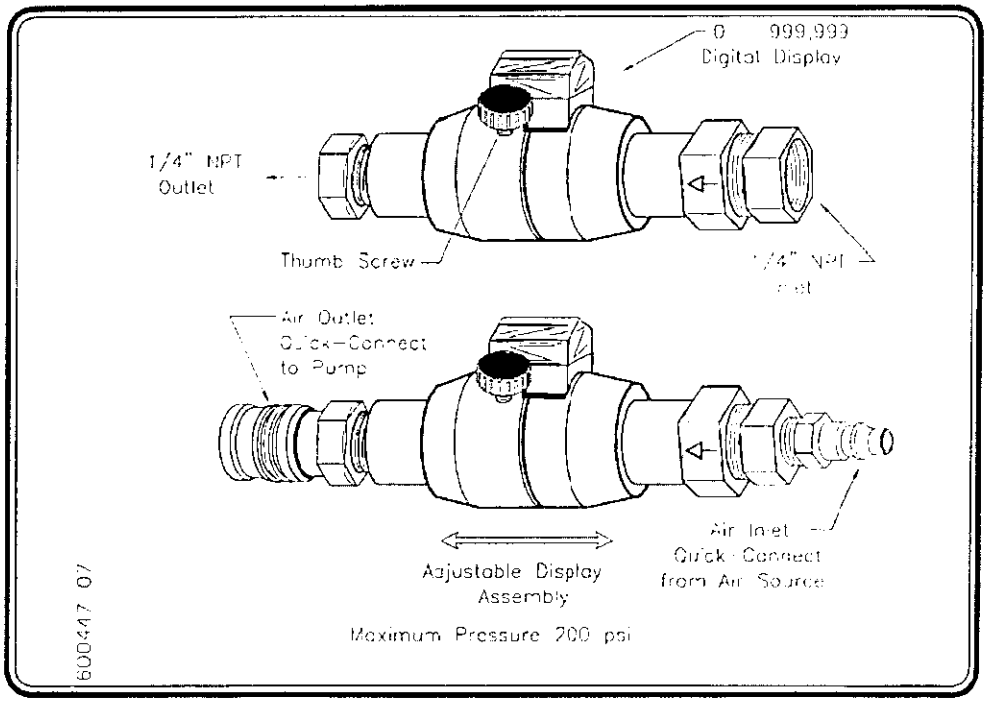


Figure 60 - Pump Cycle Counter

Pump Cycle Counter Operation/Installation

When a pneumatically operated pump such as the *QED* AutoPump® has filled, it triggers itself "On". This allows air to flow to the pump until a certain volume of fluid has discharged. The air stops; the pump fills; then the cycle continues to repeat.

A PCC mounted between a filter/regulator and a pump senses air flow to the pump. In a piston-like action, the internally located magnet shuttle moves forward (in the direction of air flow) during the "On" pulse and returns to a seated position in the "Off" period. **(See Figure 61)**

The digital display senses the completion of this "to-and-from" movement and records the cycle, increasing the number one digit that is shown in the clear plastic display.

This process repeats itself for each pump cycle.

Note:
The PCC will not function properly beyond certain distance limits from the pump, or, above or below optimum air line diameters. Safe limits are as follows:

AP-4: 250 ft. maximum with 1/4 inch or 3/8 inch ID air hose.
AP-3: 150 ft. maximum with 1/4 inch or 3/8 inch ID air hose.
AP-2: 75 ft. maximum with 1/4 inch or 3/8 inch ID air hose.

Contact *QED* for advice.

Digital Display

The digital display has the following features:

- A six digit counter that counts from 0 - 999,999 before resetting itself.
- A clear viewing lens that is water-and-impact resistant.
- **Optional**: Switch for remote electronic readout available upon request.

Magnet Housing

The magnet housing has the following features:

- A clear mark on the outside that indicates the correct direction of air flow.
- It is made of anodized aluminum.
- It has a 1/4-inch FNPT inlet and a 3/8-inch or 1/4-inch FNPT outlet.
- It handles air pressures from 40 - 200 psi.

Hardware Options

Inlet and outlet openings can be fit with no-mix quick-connects or barb connections depending on site requirements.

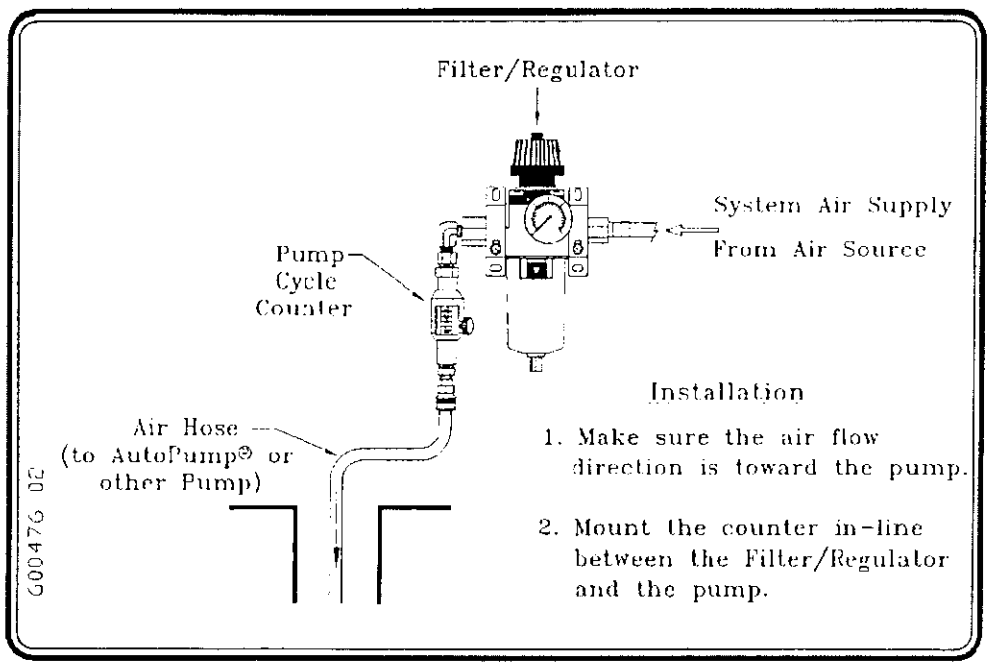


Figure 61 - Pump Cycle Counter Installation

Materials of Construction

QED PCCs are made of the following:

- Anodized Aluminum
- Stainless Steel
- Engineering Plastics
- Brass
- Viton

Pump Cycle Counter Weight - 0.4 lbs (0.2 kg)

Adjusting the Pump Cycle Counter

Note:
To get the most reliable performance, adjust the counter after it is installed and the pump is running. Typically, the Display Assembly that holds the digital readout is set 1/2-inch (13mm) from the upstream hex. Before adjusting the PCC be sure there is no air leak downstream of the counter. A leak could influence the travel of the magnet shuttle when the pump cycles.

STEP 1 - Loosen, but do not remove, the thumb screw (item #3) that locks the Display Assembly. **(See Figure 62)**

STEP 2 - Slide the Display Assembly on the magnet housing (item #6) (back and forth or up and down as the case may be) while the pump is cycling until the digital display (item #4) advances once per pump cycle.

STEP 3 - Slowly slide the Display Assembly upstream towards the air source until the digital display (item #4) stops counting. Using a pencil, mark this point on the magnet housing (item #6).

STEP 4 - Slowly slide the Display Assembly in the opposite direction, towards the pump, past where the counting occurs until the digital display (item #4) stops counting. Using a pencil, mark this point on the magnet housing (item #6).

STEP 5 - Position the Display Assembly between the two extremes where counting did not occur. Lock the Display Assembly in place with the thumb screw. (item #3)

Cleaning the Pump Cycle Counter

Sometimes the PCC does not count due to either the magnet shuttle or the spring hanging up inside the magnet housing. The counter components can be cleaned by *gently* washing the unit in warm water. A soft brush may be used to remove debris. To clean the inside, follow these instructions: **(See Figure 62)**

Note:
As a precaution, mark and/or measure with a pencil, the set distance **(See Figure 62)** so that it can be reset in the same position should movement occur. Do not loosen the thumb screw (item #3) since movement of the Display Assembly is unnecessary for cleaning.

STEP 1 - Remove the inlet fitting (item #11), not the thumb screw (item #3) as noted above.

STEP 2 - Remove the magnet shuttle assembly (item #9) and the spring (item #8) from inside the magnet housing (item #6).

STEP 3 - Inspect the magnet shuttle assembly (item #9), the spring (item #8), and the inside of the magnet housing (item #6) for burrs which may restrict the magnet shuttle assembly (item #9) movement.

STEP 4 - If burrs are present, remove the burrs and smooth the part. Replace the PCC if necessary.

STEP 5 - Use a soft bottle brush and warm water to clean the inside of the magnet housing.

Caution:
Be careful not to scratch the pieces.

STEP 6 - Let the parts dry.

STEP 7 - Reassemble the PCC.

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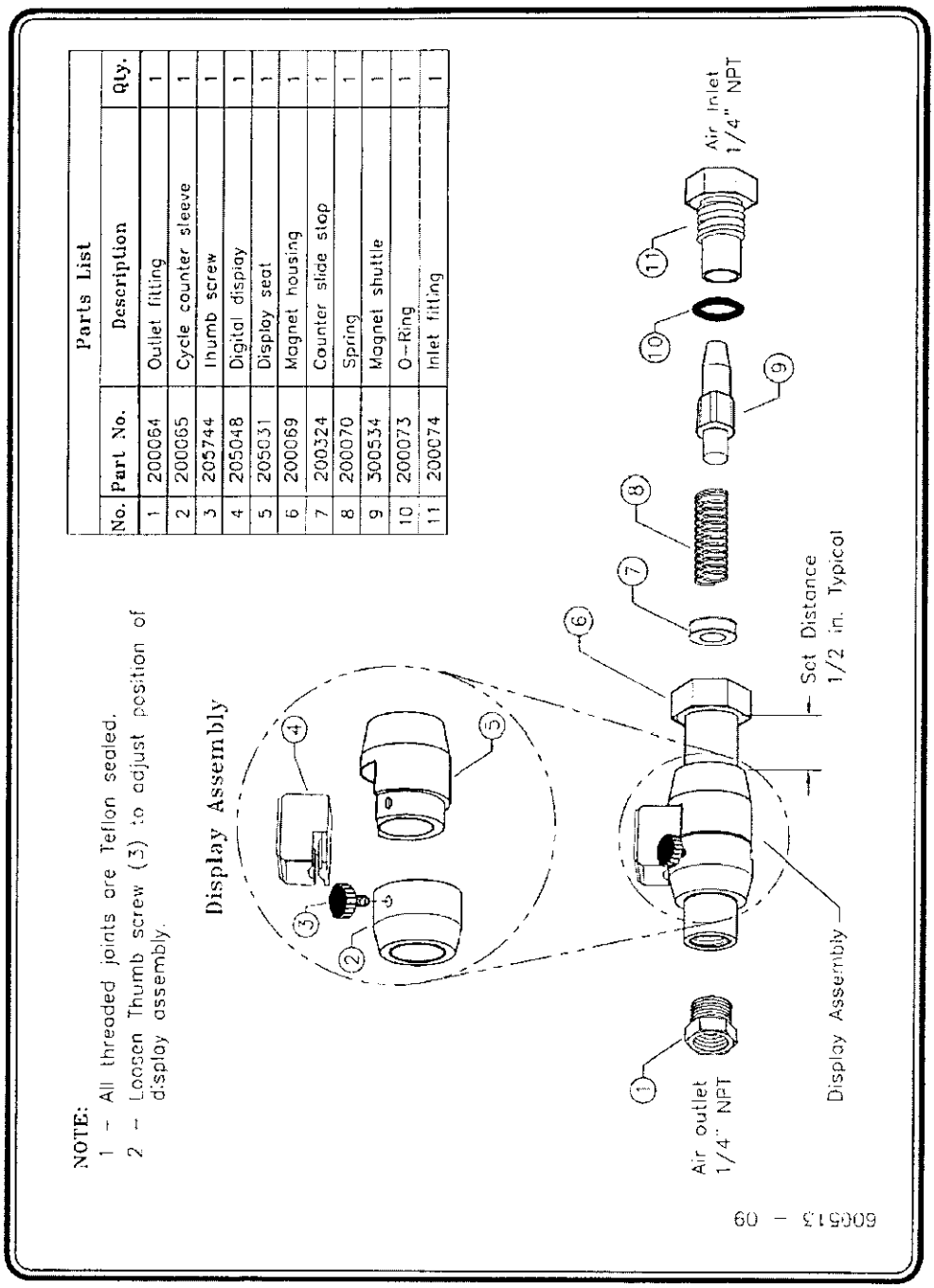


Figure 62 - Pump Cycle Counter Cleaning and Adjustment

Assembly of the Digital Display (Figure 62)

Should the digital display be removed and disassembled for any reason, the procedure for assembling is as follows:

STEP 1 - Seat the digital display (item #4) on the flat of the display seat (item #5). **(See Figure 62)**

STEP 2 - Slide the cycle counter sleeve (item #2) over the display seat (item #5) and the bottom lip portion of the digital display (item #4). Both pieces (the display seat #5 and the digital display #4) should be held in place by the cycle counter sleeve (item #2).

STEP 3 - Align the thumb screw holes.

STEP 4 - Screw in the thumb screw (item #3) to hold the Display Assembly together.

AP-4 Volumes Pumped Per Cycle

The volume of fluid pumped per cycle from an AutoPump® varies depending upon the inlet air pressure and the total developed head (TDH) (static plus dynamic head). The closer the pressures are to each other, (the TDH is almost the same as the inlet air pressure), the closer the volume pumped per cycle will be to the lower end of the gallon range in the table below. The TDH depends upon back pressure in the surface lines, hose size, fittings, vertical and horizontal pumping distance, the number of pumps feeding the hose system, air pressure to the pump, and the type of pump. The effects of some of these variables may cause the volume pumped per cycle to vary from pump to pump on a single site.

AP4 AutoPump Models

Pump	Volume per Cycle: Range	Volume per Cycle: Typical
Long AP4	0.58 - 0.78 gal (2.2 - 3.0 L)	0.65 gal (2.46 L)
Short AP4	0.22 - 0.36 gal (0.87 - 1.36 L)	0.25 gal (0.95 L)
Low Drawdown AP4	0.11- 0.16 gal (0.42 - 0.61 L)	0.13 gal (0.51 L)

Terms, Conditions, and Warranty

Five Year Warranty
This limited warranty is in lieu of and excludes all other representations made by advertisements, distributors, agents, or manufacturers sales representatives, and all other warranties, both express and implied. There are no implied warranties of merchantability or of fitness for a particular purpose for goods covered hereunder.

QED Environmental Systems warrants to the purchaser of its products that, subject to the limitations and conditions provided within the Terms & Conditions of Sale, products, materials and/or workmanship shall reasonably conform to descriptions of the products and shall be free of defects in material and workmanship.

All warranty durations are calculated from the original date of purchase – determined as beginning the date of shipment from QED facilities and the date QED is notified of a warranty claim. This warranty shall be limited to the duration and conditions set forth below:

1. **AP-4 AutoPumps** – warranted for five (5) years: 100% material and 100% workmanship for the first three (3) years; 50% material and 50% workmanship for the fourth (4th) and fifth (5th) years. This limited warranty coverage only applies to AP-4 AutoPumps purchased with this warranty. There will be no warranty for application or material compatibility. The materials used in pumps vary depending upon application and the customer is responsible for knowing the environment in which the pump will be operating and working with QED to determine what materials of construction will be best for the application.

   The warranty is valid when the following conditions exist: when the site has a pH between 4 and 9, has a salinity of 3500 ppm or less, is between 40 and 120 degrees Fahrenheit, is non-corrosive to the construction materials of the pump; and is not abrasive. Typical commercial fuels are acceptable materials in free or dissolved phase. The pumps and accessories must be operated within the specifications and limits given in the manual for the particular piece of equipment.

2. **Pumps, hose, tubing, fittings, heater, condensers and air filtration housings** — warranted for one (1) year: 100% material and 100% workmanship. This does not include AP-4 AutoPumps. There will be no warranty for application or material compatibility. The materials used vary depending upon application and the customer is responsible for knowing the environment in which the equipment will be operating and working with QED to determine what materials of construction will be best for the application.

3. **Pneumatic Data Modules / Logic Control Panels** — warranted for one (1) year: 100% material and 100% workmanship.

4. **Parts and Repairs** — warranted for ninety (90) days: 100% material and 100% workmanship; when repairs are performed by QED or its appointed agent: from date of repair or for the full term of the original warranty, whichever is longer. Separately sold parts are warranted for ninety (90) days: 100% materials and 100% workmanship.

This warranty will be void in the event of unauthorized disassembly of component assemblies. Defects in any equipment that result from abuse, operation in any manner outside the recommended procedures, use and applications other than for intended use or exposure to chemical or physical environments beyond the designated limits of materials and construction, will also void the warranty.

Chemical attack by liquids and/or abrasive substances contacting equipment and accessories shall not be covered by this warranty. A range of materials of construction is available from QED and it is the Buyer's responsibility to select materials of construction to fit the Buyer's application. QED will only warrant that the supplied site liquid contacting materials will conform to published QED specifications and generally accepted standards for that particular material.

QED Environmental Systems shall be released from all obligations under all warranties if any product covered hereby is repaired or modified by persons other than QED service personnel (unless such repair by others is made with the written consent of QED); resold to other parties; and/or moved to or used on a remediation site other than originally specified.

It is understood and agreed that QED Environmental Systems shall in no event be liable for incidental or consequential damages resulting from its breach of any of the terms of this agreement, nor for special damages, nor for improper selection of any product described or referred to for a particular application. Liability under this warranty is limited to repair or replacement F.O.B. QED's factory, or its appointed agent's shop, of any parts which prove to be defective within the duration and conditions set forth herein, or repayment of the purchase price at the option of QED, provided the products have been returned in accordance with the duration and conditions set forth herein.

Subassemblies and Other Equipment Manufactured by Others
The foregoing warranty does not apply to major subassemblies and other equipment, accessories, and other parts manufactured by others, and such other parts, accessories, and equipment are subject only to the warranties, if any, supplied by their respective manufacturers. QED makes no warranty concerning products or accessories not manufactured by QED. In the event of failure of any such product or accessory, QED will give reasonable assistance to Buyer in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

Illustrations and Drawings
Reasonable Effort has been made to have all illustrations and drawings accurately represent the product(s) as it actually was at the time of doing the illustrations and drawings.

However, products may change to meet user requirements and therefore may not be reflected in the literature. In addition, literature may be updated to reflect the most recent equipment revision(s). Changes to either or both equipment and/or literature can be made without notice.

Buyer's Remedies
The buyer's exclusive and sole remedy on account of or in respect to the furnishing of defective material or workmanship shall be to secure replacement thereof as aforesaid. QED shall not in any event be liable for the cost of any labor expended on any such product or material or for any special, direct, indirect or consequential damages to any one by reason of the fact that it shall have been deemed defective or a breach of said warranty.

Changes without Notice
Prices and Specifications are subject to change without notice.

Shipping Dates
Shipping dates are approximate and are subject to delays beyond our control.

F.O.B. Point and Title
All material is sold F.O.B. factory. Title to all merchandise sold shall pass to Buyer upon delivery by Seller to carrier at factory. All freight insurance is the responsibility of the Buyer and shall be charged to the Buyer on the invoice unless directed in writing. All Freight claims are the Buyer's responsibility.

Terms
Payment terms are Net 30 days; 1.5% per month past due.

State and Local Taxes
Any taxes, duties or fees which the seller may be required to pay or collect upon or with respect to the sale, purchase, delivery, use or consumption of any of the material covered hereby shall be for the account of the Buyer and shall be added to the purchase price.

Acceptance
All orders shall be subject to the terms and conditions contained or referred to in the Seller's quotation, acknowledgments, and to those listed here and to no others whatsoever. No waiver, alteration or modification of these terms and conditions shall be binding unless in writing and signed by an executive officer of the Seller. All orders subject to written acceptance by QED Environmental Systems, Ann Arbor, MI, U.S.A.

Warranty Claims Procedure (Responsibility of purchaser)
The original purchaser's sole responsibility in the instance of a warranty claim shall be to notify QED or its appointed agent, of the defect, malfunction, or other manner in which the terms of this warranty are believed to be violated. The purchaser may secure performance of obligations hereunder by contacting the Customer Service Department of QED or its appointed agent, and:

1. Identifying the product involved by model or serial number, or other sufficient description, that will allow QED, or its appointed agent, to determine which product is defective.

2. Specifying where, when, and from whom the product was purchased.

3. Describing the nature of the defect or malfunction covered by this warranty.

4. After obtaining authorization from QED, sending the malfunctioning component via a RMA# (Return Material Authorization number) to the address below or to its appointed agent:

QED Environmental Systems
1133 Seventh Street
Oakland, CA 94607
USA

(800) 537-1767 Toll-Free in North America
(510) 891-0880
(510) 444-6789 FAX

5. Equipment must be cleaned before shipment or it will be cleaned by QED before any work is performed. The customer will be charged for such cleaning.

If any product covered hereby is actually defective within the terms of this warranty, purchaser must contact QED, or its appointed agent, for determination of warranty coverage. If the return of a component is determined to be necessary, QED, or its appointed agent, will authorize the return of the component at Purchasers expense. If the product proves not to be defective within the terms of this warranty, then all costs and expenses in connection with the processing of the Purchaser's claim and all costs for repair, parts, labor, and shipping and handling, as authorized by owner hereunder, shall be borne by the Purchaser. In no event shall such allegedly defective products be returned to QED, or its appointed agent, without its consent, and QED's, or its appointed agent's, obligations of repair, replacement or refund are conditional upon the buyer's return of the defective product to QED, or its appointed agent. All equipment returned to QED will be appropriately cleaned of contamination before shipping.

APPENDIX K

SEWAGE PUMP MANUAL

OWNER'S MANUAL

SUBMERSIBLE EFFLUENT & SEWAGE PUMPS WS SERIES

⚠ SAFETY WARNINGS



BEFORE OPERATING OR INSTALLING THIS PUMP, READ THIS MANUAL AND FOLLOW ALL SAFETY RULES AND OPERATING INSTRUCTIONS.

⚠ **SAFETY** **CAREFULLY READ THESE SAFETY MESSAGES IN THIS MANUAL AND ON PUMP.**

⚠ **CAUTION**

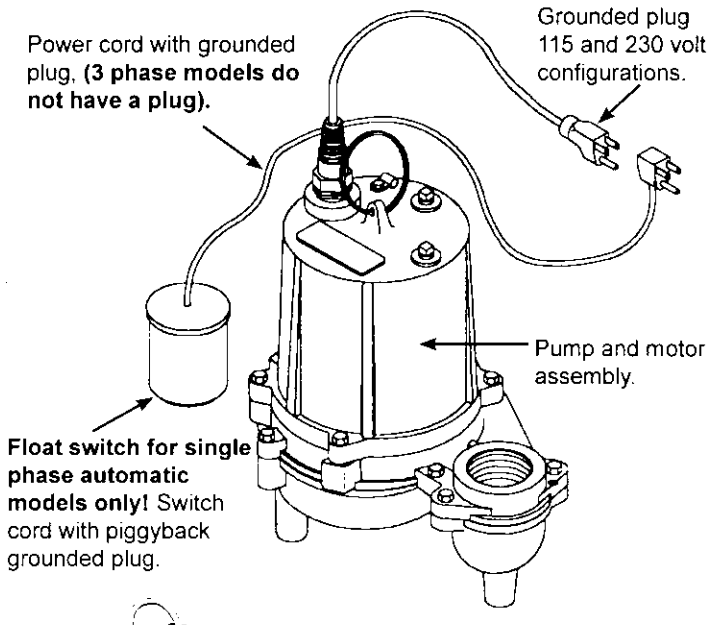
- Review instructions before operating.

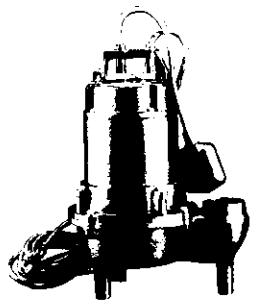
⚠ **WARNING - ELECTRICAL PRECAUTIONS**

All wiring, electrical connections, and system grounding must comply with the National Electrical Code (NEC) and with any local codes and ordinances. Employ a licensed electrician.

⚠ **WARNING - RISK OF ELECTRICAL SHOCK**

- Have an electrician provide electrical power to motor.
- A ground fault interrupter (GFI) protected circuit is recommended for use with any electrical device operating near water.





NOTE:
For automatic built-in float switch models, both the power and switch cords use the same grounded plug.

- ❑ A ground fault interrupter (GFI) protected circuit is recommended for use with any electrical device operating in or near water.
- ❑ Have a licensed and qualified electrician provide electrical power to the pump.
- ❑ Make sure the line voltage and frequency of the electrical current supply matches the specifications printed on the pump nameplate.
- ❑ Ensure the pump and electrical supply system are properly grounded. Never install or test a pump without proper electrical grounding of the system.
- ❑ Always disconnect pump from power source before handling or servicing.
- ❑ This product (Single Phase - 115 & 230 volt units ONLY) is furnished with a 3-prong plug for grounding; connect only to properly grounded receptacle.

  NEVER UNDER ANY CIRCUMSTANCES REMOVE OR DISABLE THE GROUND PLUG.
- ❑ Keep electrical plug dry - do not lift pump using cord.
- ❑ Not investigated for use in swimming pools.

EFFLUENT & SEWAGE APPLICATIONS - UP TO 3/4" & 2" SOLIDS HANDLING CAPABILITY

- ❑ These pumps are for use in effluent or raw sewage applications where the total head required (including pipe friction losses) does not exceed the pump's maximum capability. Sewage type pumps can be used in raw sewage or effluent applications.
- ❑ Additionally, the maximum solids size, as shown in Fig.1, must not be exceeded.

INSTALLATION RECORD

For future reference, keep an accurate record of your installation. Be sure to record the installation data in the area provided below.

Purchased from: _____

Phone No. ( ) _____

Pump Model No. _____

Pump Serial No. _____

Date of Installation: _____

Installation by: _____

Phone No. ( ) _____

Pump Tank or Basin Size: _____ Capacity

Discharge Pipe size: _____ Inches

Discharge Elevation: _____ Feet

TABLE OF CONTENTS

Safety, Regulatory and Electrical Warnings ..... Throughout manual

Application ..... Page 2

Installation Records and Table of Contents ..... Page 2

Installation Information and Typical Installation Drawings ..... Pages 2, 3, 4 & 5

Start Up and Operational Check ..... Page 6

Safety Tips and Maintenance ..... Page 6

Troubleshooting ..... Page 7

Warranty ..... Page 8

PERFORMANCE

Pump-Model Suffix	Solids Handling (inches)	H.P.	RPM	Total Head in Feet — Capacities in U.S. GPM													Shut-Off Head (ft.)
				5	10	15	20	25	30	35	40	50	60	70	80	90	
Effluent																	
WS30	11/16	1/3	1750	105	90	70	45	15									28
WS50	3/4	1/2	3450	106	90	80	65	53	36	21	6						42
WSV50H	3/4	1/2	3450				84	73	62	48	29						45
WS50H	3/4	1/2	3450		115	107	98	87	78	68	57	30	0				60
WS100H	3/4	1	3450		150	145	140	134	128	122	115	97	76	53	27	0	90
WS102H	2	1	3450			170	152	127	98	75	46						48
Sewage																	
WS41	7/8	4/10	1750	118	95	70	40	8									26
WS51	1 3/8	1/2	1750	155	120	83	52	14									27
WS52	2	1/2	1750	135	90	47	14										23
WS52H	2	1/2	3450		130	96	66	31									29
WS102	2	1	1750		175	149	118	85	46	16							37
WSV52	2	1/2	1750	112	80	40											18
WSV52H	2	1/2	3450		69	44	19										23

INSTALLATION

1. ⚠ WARNING - ELECTRICAL PRECAUTIONS

Before installation, check the national and local electrical and plumbing codes/ordinances.... A pump intended for use in a septic tank/sump or sewage installation requires that the tank/sump **MUST BE VENTED IN ACCORDANCE WITH LOCAL PLUMBING CODES**, and is **NOT TO BE INSTALLED IN LOCATIONS CLASSIFIED AS HAZARDOUS IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE ANSI / NFPA 70-1990.**

These regulations are for your safety and protection.

2. LOCATION:

Installation of the pump must be made in a location that....

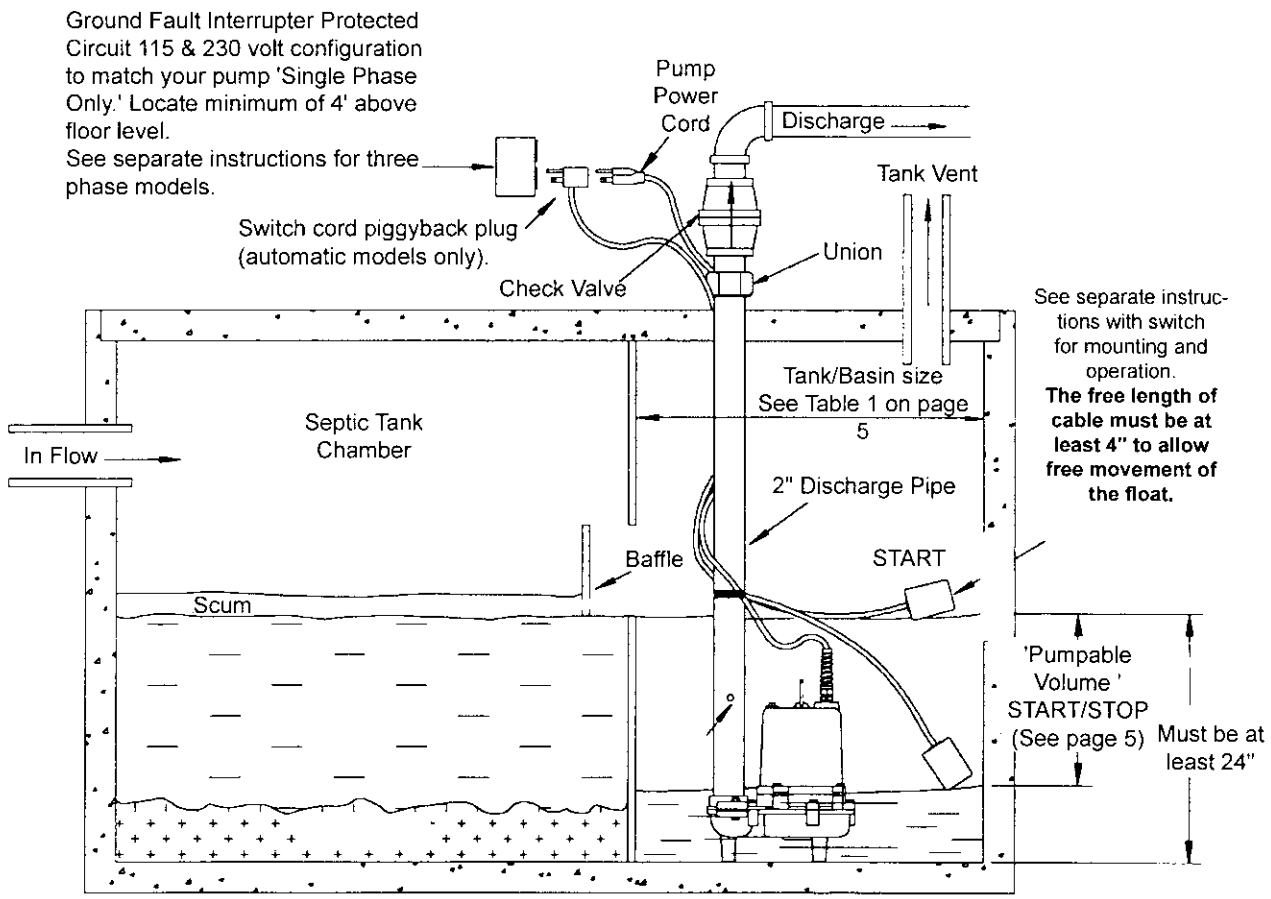
a) Has adequate room for servicing and is of adequate size (see page 5).

b) Location is protected from freezing.

c) Will require minimum lengths of piping to keep friction losses as low as possible.

d) Refer to Fig. 2 below for typical effluent/sewage installation with automatic operation.

Fig. 2
TYPICAL EFFLUENT/SEWAGE SUMP INSTALLATION
Automatic single phase 115 or 230 volt units illustrated



INSTALLATION

3. SEPTIC TANK/SUMP PREPARATION AND REQUIREMENTS:

⚠ WARNING - ELECTRICAL PRECAUTIONS

A SEPTIC SUMP CONDITION MAY EXIST. IF ENTRY INTO SUMP IS NECESSARY, then first provide proper safety precautions per OSHA requirements and secondly, DO NOT ENTER SUMP UNTIL THESE PRECAUTIONS ARE STRICTLY ADHERED TO.

- ❑ Do not smoke or use sparkable electrical devices or flame in a septic (gaseous) or possible septic sump.
- ❑ Do not install pump in location classified as hazardous per National Electrical Code ANSI/NFPA 70 - 1990. **See Warning notes on page 3 of this manual.**

a) Gas tight and properly vented with national & local electrical and plumbing codes.

b) Level bottom of sump. DO NOT SET PUMP DIRECTLY ON BOTTOM OF SUMP IF IT IS NOT SOLID. Raise the pump by using brick or concrete blocks beneath it.

c) Make sure sump is clean and free of nails, gravel, string, cloth, debris, etc. before installing pump.

Refer to Fig. 3 and associated Table to select a basin size or diameter and float switch tether length that will allow a sufficient 'pumpable volume' to prevent short cycling.

Ensure basin DEPTH is sufficient to allow for: (1) The "ON/OFF" range of the switch; and (2) the bottom of the basin must be at least 24" below the basin inlet.

Ground Fault Interrupter Protected Circuit, 115 and 230 volt configuration to match your pump 'Single Phase Only.' Locate minimum of 4' above floor level. See separate instructions for three phase models.

Fig. 3

TYPICAL EFFLUENT OR SEWAGE TANK / BASIN INSTALLATION

Automatic single phase 115 or 230 volt unit installation

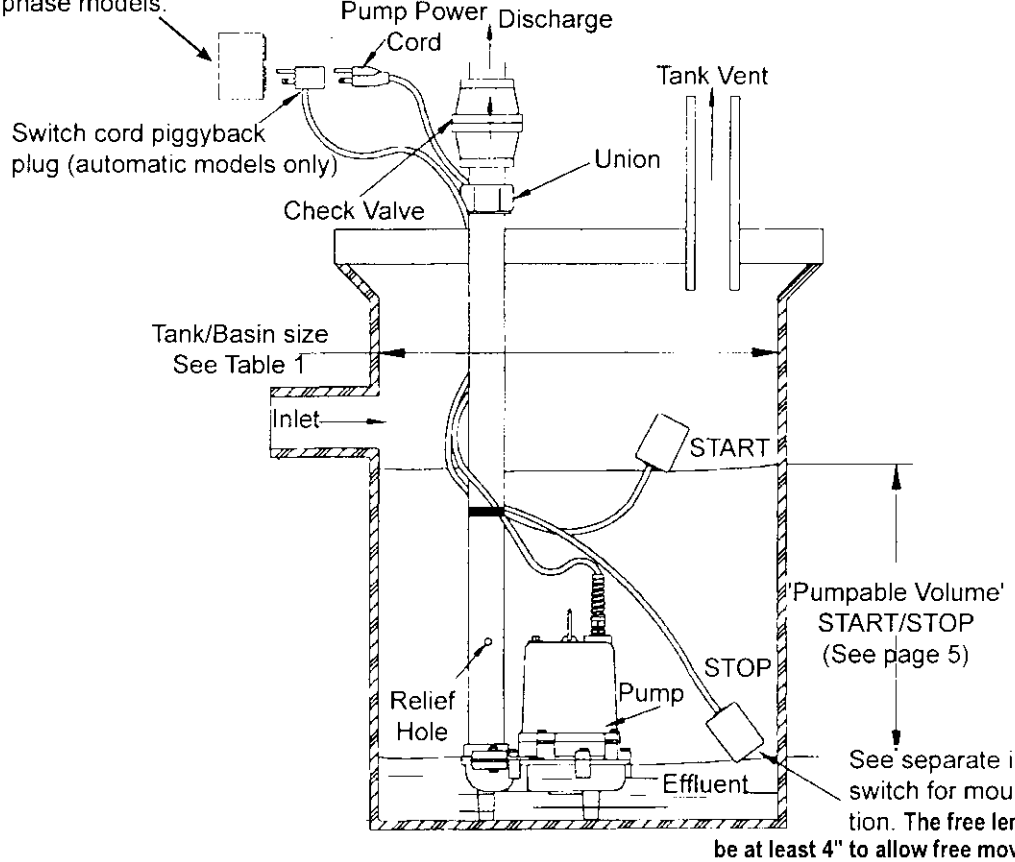


TABLE 1

Approximate 'pumpable volume' (gallons) for various combinations of basin diameters and float switch tether lengths.....

Tank Basin Dia. (Inches)	Tether Length Of Float Switch (inches)					
	6	8	10	12	14	16
	Approx Float Switch Range (inches)					
	10	12	16	18	22	25
	Pumped Volume (US Gallons)					
18	11	13	17	20	-	-
24	20	23	31	35	43	49
30	31	37	49	55	67	76
36	44	53	70	79	97	110
48	78	94	125	141	172	195
60	122	147	196	220	269	305
72	176	211	282	317	387	440

4. PLUMBING: PUMP AND DISCHARGE PIPING

a) Use steel or plastic pipe for all connecting lines between pump and sewer outlet. Keep pipe length to a minimum to reduce friction losses. Pump is equipped with a 2" NPT female outlet - DO NOT REDUCE TO A SMALLER SIZE.

NOTE: Fluid flow velocity in the pump's discharge line must be at least two feet per second to carry the effluent without clogging. This is ensured if pump flow is at least:

21 GPM through a 2" pipe
30 GPM through a 2-1/2" pipe
46 GPM through a 3" pipe

⚠ **WARNING: Some city regulations DO NOT allow the installation of a pump with plastic pipe. Check local regulations.**

b) A union or quick disconnect connection should be installed to facilitate pump removal if necessary. A FULL FLOW CHECK VALVE IS RECOMMENDED AFTER THE UNION TO PREVENT BACKFLOW AFTER EACH PUMPING CYCLE.

NOTE: When a check valve is used, drill a 1/8" or 3/16" air relief hole in the discharge pipe. This hole should be located below the floor line within the sealed pump unit and between the pump and check valve (see Fig. 2 & 3). Without this relief hole, the pump can air lock and will not pump even though it will run.

5. MOUNTING THE FLOAT SWITCH: AUTOMATIC OPERATION MODELS ONLY

a) **All automatic models;** Single Phase 115 and 230 volt models come supplied with a float switch for mounting to the pump's discharge pipe and requires final adjustment to suit your systems needs.

b) The float switch is equipped with a cord and 115 or 230 volt grounded piggyback plug configuration (depending on the voltage rating of the model you have). The switch provides automatic operation of the pump in water, effluent and sewage applications.

⚠ **WARNING - RISK OF ELECTRICAL SHOCK**

c) The float switch is packaged separately within the pump carton and includes the switch manufacturer's assembly, adjustment, operation, safety and cautionary instructions.... **Follow the manufacturer's instructions explicitly for proper installation and operation. The free length of cable must be at least 4" to allow free movement of the float.**

6. MANUAL MODELS: SINGLE PHASE 115 AND 230 VAC MODELS

a) Single Phase 115 or 230 volt manual models DO NOT INCLUDE A FLOAT SWITCH.

b) The pump comes equipped with a power cord and 115 or 230 volt grounded plug configuration (depending on the voltage rating of the model you have).

c) Plug in or unplug pump power cord as needed into ground fault interrupter (GFI) protected circuit or use with an approved motor control that matches the pump/motor input rated amperes. The motor control must be properly sized for the pump, installed and wired in compliance with the National Electrical Code (NEC) and any local codes and ordinances.

7. MANUAL MODELS: THREE PHASE 230, 460 AND 575 VAC MODELS

a) Three Phase 230, 460 and 575 volt manual models DO NOT INCLUDE A FLOAT SWITCH.

b) The pump comes equipped with a three phase power cord **without plug** for use with approved motor control that matches pump/motor rated amperes with overload element(s) selected or adjusted in accordance with the control manufacturer's instructions.

c) Three phase motor control must be properly sized for pump, installed and wired in compliance with the National Electrical Code (NEC) and with any local ordinances.

START UP AND OPERATIONAL CHECK

8. AUTOMATIC MODELS (WITH FLOAT SWITCH) SINGLE PHASE 115 AND 230 VAC MODELS:

a) Connect the 3-prong grounded piggyback plug on the float switch cord into a 115 or 230 vac (depending on your model) ground fault interrupter (GFI) receptacle.

DO NOT REMOVE GROUND PRONG FROM PLUG. DO NOT USE AN EXTENSION CORD.

b) Connect the 3-prong grounded plug from the pump power cord into the piggy back receptacle on the back of switch plug. DO NOT REMOVE GROUND PRONG FROM PLUG. DO NOT USE AN EXTENSION CORD.

c) Manually fill the tank/basin with water to check the switch operation. **DO NOT RUN DRY.**

d) Ensure that the float switch hangs free and the START /STOP levels are satisfactory. The float switch **MUST NOT COME IN CONTACT WITH SIDES OR BOTTOM OF TANK / BASIN.**

e) Cycle your system a few times to ensure that its operation is satisfactory. Replace tank/basin cover and double check to ensure that all system components/requirements are in place.

9. MANUAL MODELS: SINGLE PHASE 115 AND 230 VAC MODELS

a) Manually fill the tank/basin with water to check the pump's operation. **DO NOT RUN DRY.**

b) Connect the 3-prong grounded plug on the pump power cord into 115 or 230 VAC (depending on your model) ground fault interrupter (GFI) receptacle or approved motor control. **DO NOT REMOVE GROUND PRONG FROM PLUG. DONOT USE AN EXTENSION CORD.**

c) Cycle your system a few times to ensure that its operation is satisfactory. Replace tank/basin cover and double check to ensure that all system components/requirements are in place.

10. MANUAL MODELS: THREE PHASE 230, 460 & 575 VAC MODELS

a) Manually fill the tank/basin with water to check the pump's operation. **DO NOT RUN DRY.**

b) After the pump power cord has been wired to an approved, properly sized and grounded three phase motor control, cycle your system a few times to ensure that its operation is satisfactory. Replace tank/basin cover and double check to ensure that all system components/requirements are in place.

SAFETY TIPS AND MAINTENANCE

11. SAFETY TIPS ⚠ WARNING: RISK OF ELECTRICAL SHOCK - BODILY INJURY

a) Always wear rubber boots when you must unplug the pump from the power supply.

b) Never make adjustments or do maintenance checks with power connected. Always disconnect your pump from the electrical power supply before beginning ANY service.

c) **DO NOT SMOKE OR USE SPARKABLE ELECTRICAL DEVICES OR FLAME IN A SEPTIC (GASEOUS) SUMP.**

d) **A SEPTIC SUMP CONDITION MAY EXIST.** If entry into sump is necessary, first provide proper safety precautions per OSHA requirements and secondly, **DO NOT ENTER SUMP UNTIL THESE PRECAUTIONS ARE STRICTLY ADHERED TO.**

e) **NEVER REMOVE GROUND PRONG FROM ANY POWER OR SWITCH PLUG.** This is the ground and is there for your safety.

12. MAINTENANCE: YOUR PUMP IS CONSTRUCTED SO THAT NO REGULAR MAINTENANCE IS REQUIRED SINCE THE PUMP IS COMPLETELY SELF LUBRICATING. THE FOLLOWING ROUTINE CHECKING PROCEDURE IS RECOMMENDED TO BE CONDUCTED EACH YEAR - AND ESPECIALLY IMPORTANT FOR OCCASIONAL USE APPLICATIONS.

a) Check power cords, switch cords and electrical service outlets for damage and corrosion.

b) Ensure there is no build up of sludge, sediment or blockage in the tank/basin to clog the pump.

c) Manually raise and lower the float switch to ensure correct pump operation (important for occasional use applications).

d) Manually fill the tank/basin to check for correct switch adjustment and system operation.

TROUBLESHOOTING

13. TROUBLESHOOTING: FOLLOW ALL SAFETY TIPS, PROCEDURES AND WARNINGS PREVIOUSLY IDENTIFIED IN THIS MANUAL BEFORE TROUBLESHOOTING THE SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Motor does not run	Blown fuse	Replace
	Tripped circuit	Reset
	Disconnected plug	Reinstall
	Corroded plug	Clean prongs
	Tripped overload	Allow pump to cool, investigate cause (jammed impeller)
	Defective switch	Replace switch
	Defective motor	Repair pump or replace if necessary
	Float-improper position	Check for freedom of movement and operating levels
Motor runs but flow reduced or none at all	Impeller jammed	Disassemble pump and clean
	Plugged check valve	Remove valve and clean
	Partially blocked inlet	Clean inlet
	Line leak	Repair
	Worn impeller	Repair pump or replace if necessary
	Defective motor	Repair pump or replace if necessary
Runs continuously	Plugged pump inlet	Clean
	Defective switch	Replace switch
	Float obstruction	Adjust position of pump or float
	Plugged check valve	Remove valve, clean or replace
Pump runs but delivers less flow (Three phase units only)	Pump may be operating in wrong direction. Correct impeller rotation is counter clockwise viewing from suction inlet in bottom of pump.	⚠ **WARNING:** Make sure power supply is disconnected - TURNED OFF, then switch to any two motor leads inside the three phase motor control.

NOTE: A plugged pump inlet can be mistaken for a faulty switch. If pump runs continuously or for extended periods between turn offs, check first for a partially plugged pump inlet.

SERVICE

14. SERVICE:

a) If your pump requires service it must be repaired by an authorized MONARCH service center or warranty will be void. If a service center is not available, return your pump to the place of purchase.

b) YOUR WARRANTY IS VOID IF...

- ❑ Power cord has been cut.
- ❑ Pump has been used to pump mud, cement, tar, abrasives or chemicals.
- ❑ Pump has been used to pump hot water (above 140°F).
- ❑ Pump has been dismantled by someone other than an authorized service center.

15. WARRANTY:

LIMITED MONARCH INDUSTRIES WARRANTY

For two years from date of purchase, Monarch Industries will replace or repair for the original purchaser, free of charge, any part or parts, found upon examination by any Monarch Industries Authorized Service Depot or by the Monarch factory, to be defective in material or workmanship or both. Equipment and accessories not manufactured by Monarch Industries are warranted only to the extent of the original manufacturer's warranty. All transportation charges on parts submitted for replacement or repair under this warranty must be borne by the purchaser. For warranty service see your nearest Monarch Industries Authorized Service Depot. THERE IS NO OTHER EXPRESS WARRANTY. IMPLIED WARRANTIES INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO TWO YEARS FROM PURCHASE AND TO THE EXTENT PERMITTED BY LAW. LIABILITY FOR CONSEQUENTIAL DAMAGES UNDER ANY AND ALL WARRANTIES ARE EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW.
This warranty is an addition to any statutory warranty.

MONARCH INDUSTRIES
P.O. Box 429
Winnipeg, Manitoba, Canada
R3C 3E4
Ph: (204) 786-7921
Fax: (204) 889-9120

E-mail: orders@monarchindustries.com

www.monarchindustries.com

MANUEL DE PROPRIÉTAIRE

POMPES D'EFFLUENTS ET D'ÉGOUT SUBMERSIBLES WS SÉRIES

⚠ CONSIGNES DE SÉCURITÉ

AVANT D'INSTALLER OU D'UTILISER CETTE POMPE, PRIÈRE DE LIRE LE PRÉSENT GUIDE ET SUIVRE TOUTES LES RÈGLES DE SÉCURITÉ ET INSTRUCTIONS D'UTILISATION

⚠ SÉCURITÉ **LIRE ATTENTIVEMENT LES AVIS DE SÉCURITÉ SE TROUVANT DANS LE PRÉSENT MANUEL ET SUR LA POMPE.**

⚠ MISES EN GARDE

- Passez les instructions en revue avant d'utiliser la pompe.

⚠ AVERTISSEMENT - PRÉCAUTIONS ÉLECTRIQUES

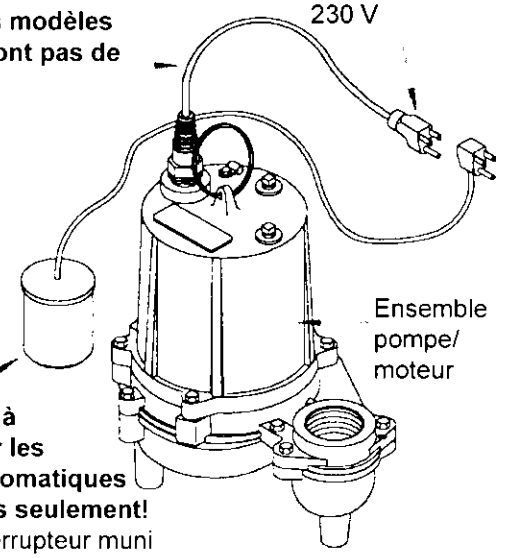
Tous câblage, connexions électriques et mise à la terre des systémes doivent se conformer au Code National d'Electricité (NEC) et aux codes et ordonnances locaux. Employez un électricien autorisé.

⚠ AVERTISSEMENT - RISQUE DE CHOC ÉLECTRIQUE

- Faire appel à un électricien pour l'alimentation électrique du moteur.
- Un interrupteur à circuit de terre protégé (GFI) est recommandé pour l'utilisation de tout appareil électrique près de l'eau.

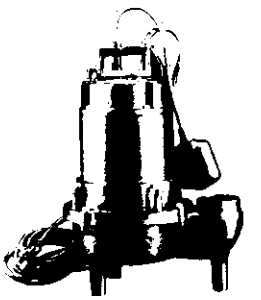
Cordon d'alimentation avec fiche munie d'une mise à la terre **(les modèles triphasés n'ont pas de fiche).**

Fiche avec mise à la terre pour configurations de 115 & 230 V



Ensemble pompe/ moteur

Interrupteur à flotteur pour les modèles automatiques monophasés seulement! Cordon d'interrupteur muni d'un ensemble fiche-prise avec mise à la terre.



NOTE:
Pour les modèles munis d'un interrupteur automatique intégré, la même fiche avec mise à terre s'utilise pour le cordon d'alimentation et celui d'interrupteur.

- ❑ L'utilisation d'un circuit protégé d'interrupteur de défaut à la terre (GFI) est recommandée pour l'opération de tout appareil électrique dans l'eau ou près de l'eau.
- ❑ Faites appel à un électricien agréé et compétent pour amener le courant électrique à la pompe.
- ❑ Assurez-vous que la tension de ligne et la fréquence de l'alimentation en courant électrique correspondent aux caractéristiques inscrites sur la plaque signalétique de la pompe.
- ❑ Assurez-vous que la pompe et le système d'alimentation en électricité sont correctement mis à la terre. Évitez d'installer ou de mettre une pompe à l'essai, si le système n'est pas convenablement mis à la terre.
- ❑ Débranchez toujours la pompe avant de la manipuler ou d'en faire l'entretien.
- ❑ Ce produit (monophasé - unités de 115 & 230 V SEULEMENT) est muni d'une prise à trois broches dont une mise à la terre; ne branchez que dans un réceptacle avec mise à la terre convenable. **NE JAMAIS, POUR QUELQUE RAISON QUE CE SOIT, RETIRER LA MISE À LA TERRE OU METTRE CELLE-CI HORS-FONCTION.**
- ❑ Gardez la fiche électrique sèche - évitez de soulever la pompe par le cordon.
- ❑ L'utilisation dans les piscines d'a pas été mise à l'épreuve.

APPLICATIONS D'EFFLUENTS ET D' EAUX D'ÉGOUT - CAPACITÉ DE PASSAGE DE SOLIDES JUSQU'À 3/4 PO. ET DE 2 PO.

- ❑ Ces pompes sont conçues pour les applications d'effluents ou d'eaux d'égout brutes dont la hauteur totale exigée (incluant les pertes dues au frottement) ne dépasse pas la capacité maximale des pompes. Les pompes de puisard peuvent être utilisées pour les applications d'effluents ou d'eaux d'égout brutes.
- ❑ De plus, la dimension maximale des solides, indiquée dans la figure 1 ci-dessous, ne doit être dépassée.

DOSSIER D'INSTALLATION

À des fins de référence ultérieure, gardez à jour un dossier de votre installation. Assurez-vous d'inscrire les données dans l'espace ci-dessous.

Acheté de : _____

N° tél : (___) _____

N° modèle/pompe _____

N° série/pompe _____

Date d'installation _____

Installation par : _____

N° tél : (___) _____

Dimension/réservoir/bassin _____ Capacité

Dimension/tuyau de refoulement _____ Pouces

Hauteur de refoulement _____ Pieds

TABLE DES MATIÈRES

Sécurité - Réglementation - Mises en garde relatives à l'électricité ..... (dans tout le manuel)
Application ..... Page 2
Dossiers d'installation et table des matières ..... Page 2
Instructions et graphiques d'installation ..... Pages 2, 3, 4 & 5
Démarrage et vérification du fonctionnement ..... Page 6
Conseils de sécurité et d'entretien ..... Page 7
Dépannage ..... Pages 7 & 8
Garantie ..... Page 8

RENDEMENT

Modele de pompe	Capacite de passage	CV	RPM	Hauteur totale en pieds — Débit en gallons U.S./MIN 5	10	15	20	25	30	35	40	50	60	70	80	90	Shut-Off Head (ft.)
Effluent																	
WS30	11/16	1/3	1750	105	90	70	45	15									28
WS50	3/4	1/2	3450	106	90	80	65	53	36	21	6						42
WSV50H	3/4	1/2	3450				84	73	62	48	29						45
WS50H	3/4	1/2	3450		115	107	98	87	78	68	57	30	0				60
WS100H	3/4	1	3450		150	145	140	134	128	122	115	97	76	53	27	0	90
WS102H	2	1	3450			170	152	127	98	75	46						48
Égout																	
WS41	7/8	4/10	1750	118	95	70	40	8									26
WS51	1 3/8	1/2	1750	155	120	83	52	14									27
WS52	2	1/2	1750	135	90	47	14										23
WS52H	2	1/2	3450		130	96	66	31									29
WS102	2	1	1750		175	149	118	85	46	16							37
WSV52	2	1/2	1750	112	80	40											18
WSV52H	2	1/2	3450		69	44	19										23

1. ⚠ AVERTISSEMENT - PRÉCAUTIONS ÉLECTRIQUES

Avant l'installation, consultez les ordonnances/codes nationaux et locaux en matière d'électricité et de plomberie.... Une pompe spécialement conçue pour utilisation dans une fosse septique ou installation de pompage **EXIGE** que le réservoir/puisard **SOIT MUNI D'UN DISPOSITIF D'AÉRATION CONFORME AUX CODES DE PLOMBERIE LOCAUX, ET ELLE NE DOIT PAS ÊTRE INSTALLÉE DANS DES ENDROITS CLASSIFIÉS COMME ÉTANT DANGEREUX EN VERTU DU CODE NATIONAL DE L'ÉLECTRICITÉ ANSI/NFPA 70-1990.** Ces règlements visent à assurer votre sécurité et votre protection.

2. EMPLACEMENT :

La pompe doit être installée dans un endroit...

a) D'une dimension convenable, où il y a suffisamment d'espace pour effectuer les travaux d'entretien (voir page 5).

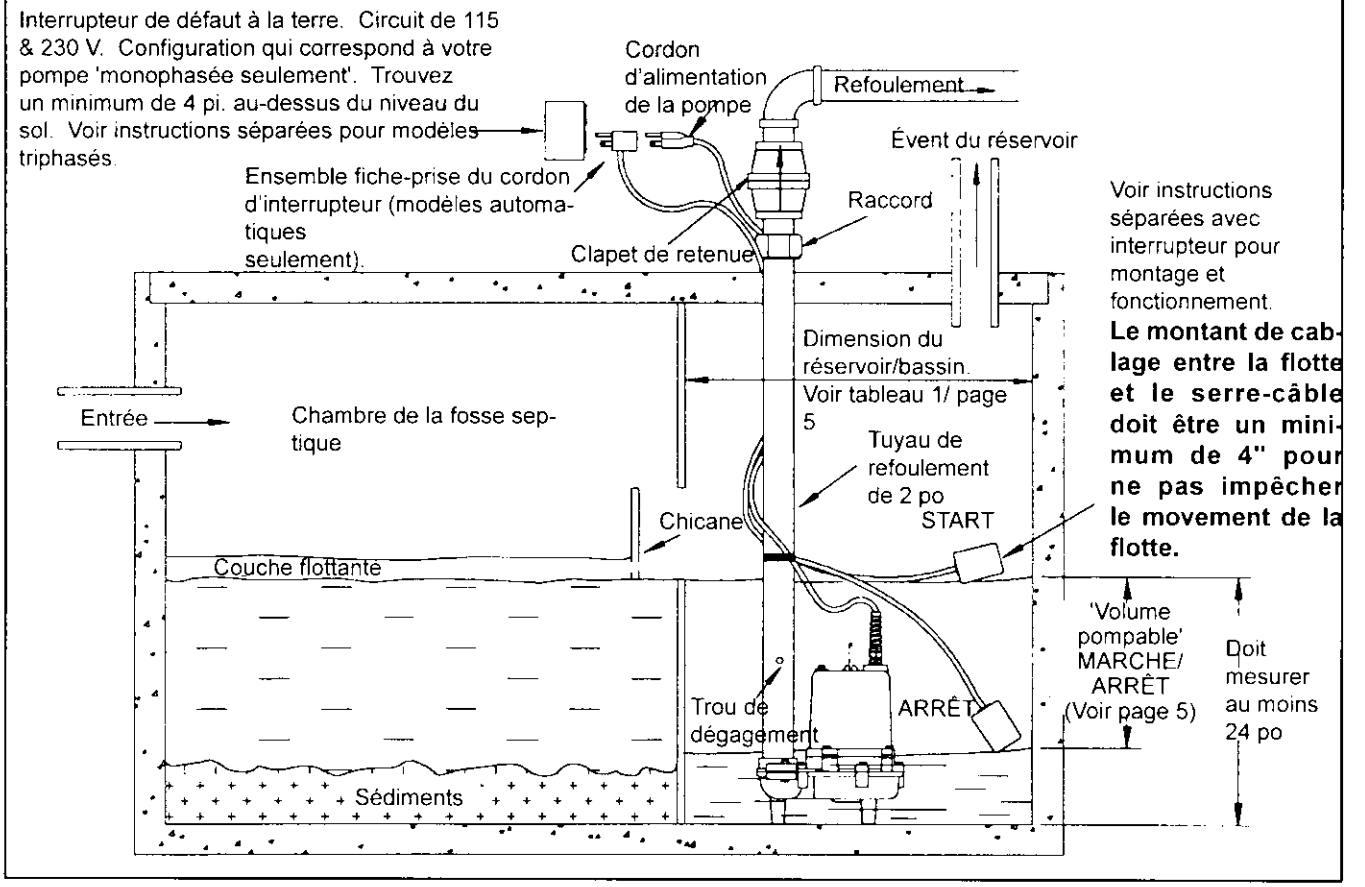
b) Protégé contre le gel.

c) Nécessitant des longueurs minimales de tuyauterie pour minimiser les pertes dues au frottement.

d) Voir figure 2 ci-dessous pour l'installation de pompes d'effluents/eaux d'égout brutes conventionnelles à fonctionnement automatique.

Fig. 2

INSTALLATION DE POMPES D'EFFLUENTS/EAUX D'ÉGOUT BRUTES CONVENTIONELLES
Monophasée automatique. Unités de 115 & 230 V. Voir illustration



3. FOSSE SEPTIQUE/PRÉPARATION DU PUISARD / EXIGENCES :

⚠ **AVERTISSEMENT - PRÉCAUTIONS ÉLECTRIQUES**

LA NÉCESSITÉ D'ENTRER DANS UN PUISARD PEUT S'AVÉRER PROBLÉMATIQUE. Vous devez d'abord fournir des consignes de sécurité qui répondent aux exigences de l'OSHA, puis ÉVITER D'ENTRER DANS UN PUISARD SANS VOUS ÊTRE RIGOUREUSEMENT CONFORMÉ À CES CONSIGNES.

- ❑ Évitez de fumer ou d'utiliser des appareils électriques susceptibles de produire des étincelles ou une flamme dans un puisard pouvant dégager des émanations de gaz.
- ❑ Évitez d'installer une pompe dans un endroit classifie comme etant dangereux en vertu du code national de l'electricite ANSI/NFPA 70-1990. **Voir les notes relatives a la mise en garde a la page 3 du present manuel.**

a) Étanche au gaz et muni d'un évent conforme aux codes nationaux et locaux d'électricité et de plomberie.

INSTALLATION

b) Mettre le fond du puisard à niveau. NE PAS INSTALLER LA POMPE DIRECTEMENT AU FOND DU PUISARD SI CELUI-CI N'EST PAS SOLIDE. Soulever la pompe avec des blocs de brique ou de ciment.

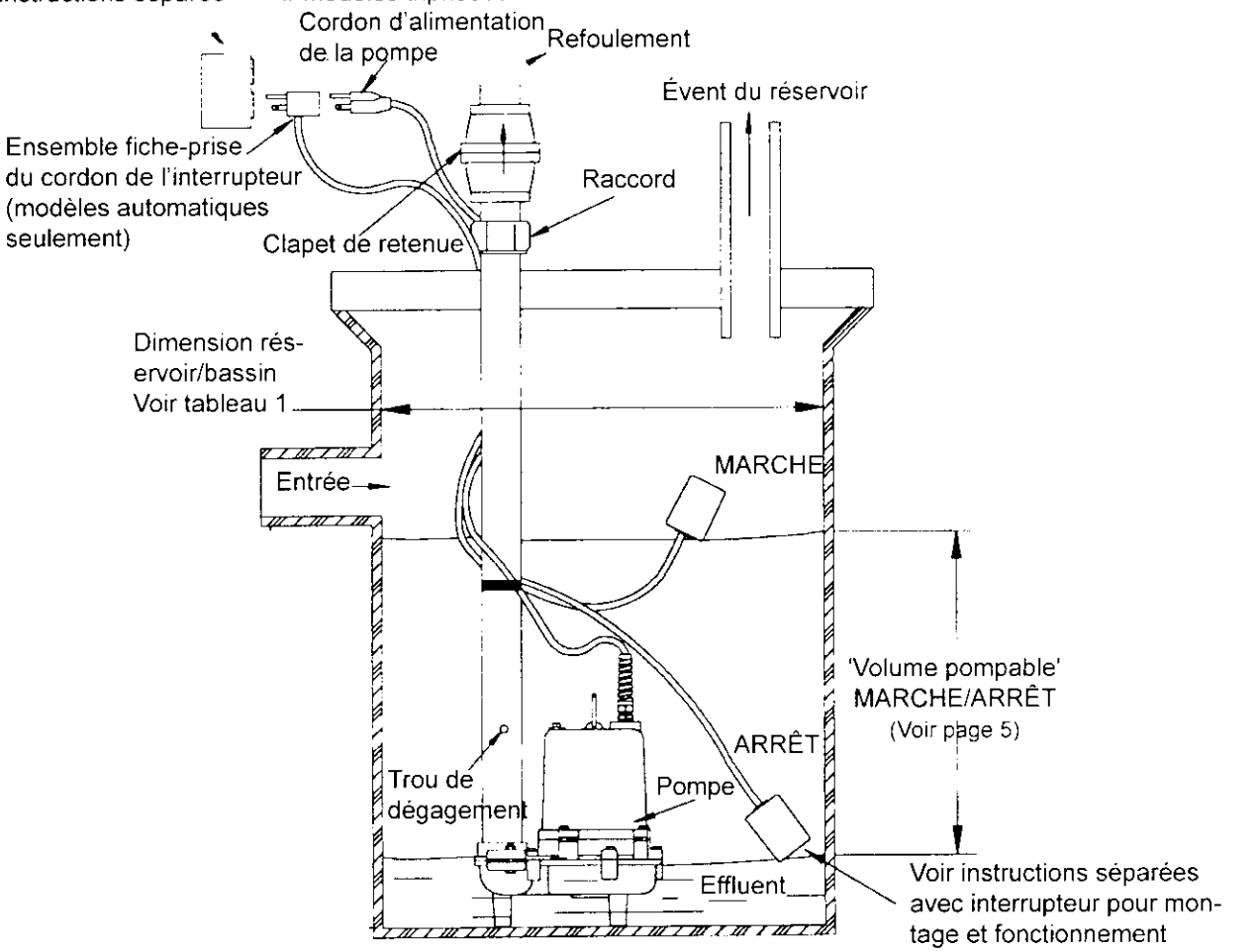
c) S'assurer que le puisard est propre et libre de clous, gravier, corde, linges, débris, avant d'installer la pompe.

Voir fig. 3 et le tableau associà pour choisir la dimension ou le diamètre du bassin et la longueur du cordon de l'interrupteur à flotteur qui permettront un 'volume pompable' suffisant pour empêcher les cycles courts. S'assurer que le bassin est assez PROFOND pour : (1) admettre la distance de la course entre la position MARCHE/ARRÊT de l'interrupteur; et (2) que le fond du bassin se trouve au moins à une distance de 24 po au-dessous de l'entrée du bassin.

Fig. 3

INSTALLATION D'UN RÉSERVOIR OU BASSIN D'EFFLUENTS / EAUX D'ÉGOUT BRUTES CONVENTIONNEL
Installation d'une unité monophasé automatique de 115 ou 230 V

Interrupteur de défaut à la terre. Circuit de 115 & 230 V.Configuration qui correspond à votre pompe 'monophasée seulement'. Trouvez un minimum de 4 pi. au-dussus du niveau du sol. Voir instructions séparées pour modèles triphasés.



Le montant de cablage entre la flotte et le serre-câble doit être un minimum de 4" pour ne pas impêcher le movement de la flotte.

TABLEAU 1

'Volume pompable' approximatif (gallons) pour diverse combinaisons de diamètres de bassins et de longueurs de cordons d'interrupteurs à flotteur...

Diamètre Réservoir /bassin (po)	LONGUEUR DU CORDON DE L'INTERRUPTEUR À FLOTTEUR [pouces]					
	6	8	10	12	14	16
	Portée approx. de l'interrupteur [pouces]					
	10	12	16	18	22	25
	Débit [en gallons US]					
18	11	13	17	20	-	-
24	20	23	31	35	43	49
30	31	37	49	55	67	76
36	44	53	70	79	97	110
48	78	94	125	141	172	195
60	122	147	196	220	269	305
72	176	211	282	317	387	440

4. PLOMBERIE : POMPE ET TUYAUTERIE DE REFOULEMENT

a) Utiliser un tuyau d'acier ou de plastique pour toutes les lignes de raccord entre la pompe et le point de rejet de l'égout. Gardez une longueur minimale de tuyau pour réduire les pertes dues au frottement. La pompe est équipée d'un orifice taraudé de 2 po NPT - NE PAS RÉDUIRE À UNE DIMENSION MOINDRE.

REMARQUE :
La vitesse d'écoulement dans la conduite de refoulement de la pompe doit être au moins de 2 pieds par seconde pour entraîner l'effluent sans colmatage. Pour ce faire, le débit de la pompe doit être au moins :

21 gpm dans un tuyau de 2 po
30 gpm dans un tuyau de 2 ½ po
46 gpm dans un tuyau de 3 po

⚠ **AVERTISSEMENT : Dans certaines villes les règlements ne permettent pas l'installation d'une pompe avec tuyauterie en plastique. Vérifiez les règlements locaux.**

b) Un raccord ou une connexion à démontage rapide devraient être installés pour faciliter l'enlèvement de la pompe si nécessaire. ON RECOMMANDE D'INSTALLER UN CLAPET DE RETENUE À GRAND DÉBIT À LA SUITE DU RACCORD POUR EMPÊCHER UN REFOULEMENT APRÈS CHAQUE CYCLE DE POMPAGE.

REMARQUE :
Si vous utilisez un clapet de retenue, percez un trou de dégagement d'air de 1/8 po ou de 3/16 po dans le tuyau de refoulement. Ce trou devrait se trouver sous la ligne de plancher à l'intérieur de l'unité de pompe étanche et entre la pompe et le clapet de retenue (voir fig. 2 & 3). Sans ce trou de dégagement, la pompe peut créer une poche d'air et ne pompera pas, même si elle continue à fonctionner.

5. MONTAGE DE L'INTERRUPTEUR À FLOTTEUR: POUR LES MODÈLES À FONCTIONNEMENT AUTOMATIQUE SEULEMENT

a) **Tous les modèles automatiques;** les modèles monophasés de 115 et 230 V sont munis d'un interrupteur à flotteur devant être raccordé au tuyau de refoulement de la pompe et ils nécessitent un réglage définitif qui convient à votre système.

b) L'interrupteur à flotteur est équipé d'un cordon et d'une configuration de 115 ou 230 V avec ensemble fiche-prise dont une mise à la terre (selon la capacité en voltage du modèle que vous possédez). L'interrupteur permet le fonctionnement automatique de la pompe dans l'eau et dans les applications d'effluents et eaux d'égout.

⚠ AVERTISSEMENT - RISQUE DE CHOC ÉLECTRIQUE

c) L'interrupteur à flotteur est dans un emballage séparé à l'intérieur du carton de la pompe, et il comprend des instructions relatives à l'assemblage de l'interrupteur, le réglage, le fonctionnement et les consignes de sécurité...**Suivez explicitement les instructions du fabricant pour obtenir une installation et un fonctionnement satisfaisants. Le montant de cablage entre la flotte et le serre-câble doit être un minimum de 4" pour ne pas impêcher le movement de la flotte.**

6. MODÈLES MANUELS : MODÈLES MONOPHASÉS DE 115 ET 230 VCA

a) Les modèles manuels monophasés de 115 ou 230 V N'INCLUENT PAS L'INTERRUPTEUR À FLOTTEUR.

b) La pompe est équipée d'un cordon d'alimentation et d'une fiche avec mise à la terre de 115 ou 230 V (selon la capacité en voltage du modèle que vous possédez).

c) Branchez le cordon d'alimentation de la pompe dans le circuit protégé de l'interrupteur de défaut à la terre ou utilisez-le avec une commande de moteur approuvée qui correspond à l'intensité du courant de la pompe/du moteur. La commande de moteur doit avoir une capacité qui convient à la pompe et être installée et câblée conformément au code national de l'électricité (NEC) et autres ordonnances ou codes locaux.

7. MODÈLES MANUELS : MODÈLES TRIPHASÉS DE 230, 460 ET 575 VCA

a) Les modèles triphasés de 230, 460 et 575 V N'INCLUENT PAS L'INTERRUPTEUR À FLOTTEUR.

b) La pompe est équipée d'un cordon d'alimentation triphasé **sans fiche** pour utilisation avec une commande de moteur approuvée qui correspond à l'intensité du courant de la pompe/du moteur et un disjoncteur de surcharge choisi ou adapté conformément aux instructions du fabricant.

c) La commande du moteur triphasé doit avoir une capacité qui convient à la pompe et être installée et câblée conformément au code national de l'électricité (NEC) et autres ordonnances ou codes locaux.

DÉMARRAGE ET VÉRIFICATION DU FONCTIONNEMENT

8. MODÈLES AUTOMATIQUES (AVEC INTERRUPTEUR À FLOTTEUR) MODÈLES MONOPHASÉS DE 115 ET 230 VCA :

a) Branchez la fiche à trois broches (dont une mise à la terre) du cordon de l'interrupteur à flotteur dans le réceptacle d'interrupteur de défaut à la terre (GFI) de 115 ou 230 VCA (selon le modèle que vous possédez).

NE RETIREZ PAS LE CONTACT DE MISE À LA TERRE DE LA FICHE. N'UTILISEZ PAS DE RALLONGE ÉLECTRIQUE.

b) Branchez la fiche à trois broches (dont une mise à la terre) du cordon d'alimentation de la pompe dans le réceptacle fiche-prise se trouvant à l'arrière de la fiche de l'interrupteur. NE RETIREZ PAS LE CONTACT DE MISE À LA TERRE DE LA FICHE. N'UTILISEZ PAS DE RALLONGE ÉLECTRIQUE.

c) Remplissez d'eau le réservoir/bassin manuellement pour vérifier le fonctionnement de l'interrupteur. NE PAS FAIRE FONCTIONNER À SEC.

d) Assurez-vous que l'interrupteur est libre de tout mouvement et que les niveaux marche/arrêt sont satisfaisants. L'interrupteur à flotteur NE DOIT PAS TOUCHER LES PAROIS OU LE FOND DU RÉSERVOIR / BASSIN.

e) Faites effectuer quelques cycles à votre système pour vous assurer qu'il fonctionne de façon satisfaisante. Replacez le couvercle du réservoir/bassin et contre-vérifiez pour vous assurer que tous les composants du système sont bien en place et qu'ils répondent aux exigences.

9. MODÈLES MANUELS : MODÈLES MONOPHASÉS DE 115 ET 230 VCA

a) Remplissez d'eau le réservoir/bassin manuellement pour vérifier le fonctionnement de la pompe. NE PAS FAIRE FONCTIONNER À SEC.

b) Branchez la fiche à trois broches (dont une mise à la terre) du cordon d'alimentation de la pompe dans le réceptacle d'interrupteur de défaut à la terre (GFI) de 115 ou 230 VCA ou dans la commande de moteur approuvée (selon le modèle que vous possédez). NE RETIREZ PAS LE CONTACT DE MISE À LA TERRE DE LA FICHE. N'UTILISEZ PAS DE RALLONGE ÉLECTRIQUE.

c) Faites effectuer quelques cycles à votre système pour vous assurer qu'il fonctionne de façon satisfaisante. Replacez le couvercle du réservoir/bassin et contre-vérifiez pour vous assurer que tous les composants du système sont bien en place et qu'ils répondent aux exigences.

10. MODÈLES MANUELS: MODÈLES TRIPHASÉS DE 230, 460 ET 575 VCA

a) Remplissez d'eau le réservoir/bassin manuellement pour vérifier le fonctionnement de la pompe (selon le modèle que vous possédez). NE PAS FAIRE FONCTIONNER À SEC.

b) Après avoir connecté le cordon d'alimentation de la pompe à une commande de moteur triphasée et approuvée, de calibre adéquat et correctement mise à la terre, faites effectuer quelques cycles à votre système pour vous assurer qu'il fonctionne de façon satisfaisante. Replacez le couvercle du réservoir/bassin et contre-vérifiez pour vous assurer que tous les composants du système sont bien en place et qu'ils répondent aux exigences.

CONSEILS DE SÉCURITÉ ET ENTRETIEN

11. CONSEILS DE SÉCURITÉ

⚠ AVERTISSEMENT : RISQUE DE CHOC ÉLECTRIQUE - BLESSURES CORPORELLES

a) Portez toujours des bottes de caoutchouc quand vous devez débrancher la pompe de sa source d'alimentation.

b) Ne faites jamais de réglages ou de vérifications de maintenance lorsqu'il y a du courant. Débranchez toujours votre pompe de sa source d'alimentation avant d'entreprendre TOUT travail d'entretien.

c) **ÉVITEZ DE FUMER OU D'UTILISER DES APPAREILS ÉLECTRIQUES SUSCEPTIBLES DE PRODUIRE DES ÉTINCELLES OU UNE FLAMME DANS UN PUISARD POUVANT DÉGAGER DES ÉMANATIONS DE GAZ.**

d) LA NÉCESSITÉ D'ENTRER DANS UN PUISARD PEUT S'AVÉRER PROBLÉMATIQUE. Vous devez d'abord fournir des consignes de sécurité qui répondent aux exigences de l'OSHA, puis ÉVITER D'ENTRER DANS UN PUISARD SANS VOUS ÊTRE RIGOUREUSEMENT CONFORMÉ À CES CONSIGNES.

e) NE RETIREZ JAMAIS LE CONTACT DE MISE À LA TERRE D'UNE FICHE D'ALIMENTATION OU D'UN COMMUTATEUR À FICHE. Il s'agit de la mise à la terre et elle y est pour votre protection.

12. ENTRETIEN : VOTRE POMPE NE NÉCESSITE AUCUN ENTRETIEN RÉGULIER ÉTANT DONNÉ QU'ELLE EST COMPLÈTEMENT AUTO-LUBRIFIANTE. ON RECOMMANDE D'EFFECTUER LES VÉRIFICATIONS PÉRIODIQUES SUIVANTES UNE FOIS L'AN - SURTOUT DANS LES CAS D'UTILISATION OCCASIONNELLE.

a) Vérifiez si les cordons d'alimentation, les cordons d'interrupteurs et les prises de courant sont endommagés ou corrodés.

b) Assurez-vous que la pompe n'est pas bloquée en raison d'une accumulation de sédiments boueux dans le réservoir/bassin.

c) Levez et baissez manuellement l'interrupteur à flotteur pour vous assurer que la pompe fonctionne correctement (important dans les cas d'utilisation occasionnelle)

d) Remplir le réservoir/bassin manuellement pour vérifier l'exactitude du réglage de l'interrupteur et le bon fonctionnement du système.

DÉPANNAGE

13. DÉPANNAGE: SUIVRE LES CONSEILS DE SÉCURITÉ, LES PROCÉDURES ET LES MISES EN GARDE DÉCRITES DANS LE PRÉSENT GUIDE AVANT DE DIAGNOSTIQUER LA PANNE

PROBLÈME	CAUSE PROBABLE	SOLUTION
Le moteur ne fonctionne pas	Fusible sauté	Remplacer
	Circuit d'enclenchement	Réamorcer
	Fiche débranchée	Réinstaller
	Fiche corrodée	Nettoyer les broches
	Disjoncteur de surcharge	Laisser refroidir la pompe, chercher la cause (roue de turbine bloquée)
	Interrupteur défectueux	Remplacer l'interrupteur
	Moteur défectueux	Remplacer ou réparer la pompe
	Position incorrecte du flotteur	Vérifier la liberté de mouvement et les niveaux de fonctionnement
Le moteur tourne mais le débit est moindre ou inexistant	Roue de turbine bloquée	Démonter et nettoyer la pompe
	Clapet de retenue colmaté	Retirer et nettoyer le clapet
	Orifice d'aspiration partiellement bloqué	Nettoyer l'orifice d'aspiration
	Conduit fuyant	Réparer
	Roue de turbine usée	Réparer ou remplacer la pompe
	Moteur défectueux	Réparer ou remplacer la pompe

DÉPANNAGE

PROBLÈME	CAUSE PROBABLE	SOLUTION
Le moteur tourne sans arrêt	Orifice d'aspiration bloqué	Nettoyer
	Interrupteur défectueux	Remplacer l'interrupteur
	Flotteur obstrué	Régler la position de la pompe ou de l'interrupteur
	Clapet de retenue colmaté	Retirer, nettoyer ou remplacer le clapet
La pompe fonctionne mais le débit d'eau et la pression sont plus faibles que d'habitude. (unités triphasées seulement)	Il se peut que la pompe fonctionne dans le mauvais sens. La rotation anti-horaire quand on regarde l'orifice d'aspiration dans le fond de la pompe.	⚠ **MISE EN GARDE** : S'assurer que la source d'alimentation est débranchée - EN POSITION ARRÊT correcte de la roue de turbine est - et inverser deux des FILS CONDUCTEURS à l'intérieur de la commande de moteur triphasée.

REMARQUE : On peut facilement se tromper et penser que l'orifice d'aspiration de la pompe est bloqué, alors que c'est l'interrupteur qui est défectueux. Si la pompe fonctionne sans arrêt, ou qu'il s'écoule de longues périodes entre les arrêts cycliques, vérifier d'abord si l'orifice d'aspiration de la pompe est partiellement colmaté.

SERVICE

14. SERVICE:

a) Si votre pompe nécessite une réparation, adressez-vous à un centre de service MONARCH autorisé, sinon votre garantie sera nulle. S'il n'y a pas de centre de service près de chez vous, retournez votre pompe à l'endroit où vous l'avez achetée.

b) VOTRE GARANTIE EST NULLE SI...

- ❑ Le cordon d'alimentation a été coupé.
- ❑ La pompe a été utilisée pour pomper de la boue, du ciment, du goudron des matières abrasives ou chimiques.
- ❑ La pompe a été utilisée pour pomper de l'eau chaude (au-dessus de 140° F).
- ❑ La pompe a été démontée par un réparateur autre qu'un centre de service autorisé.

15. GARANTIE :

GARANTIE LIMITÉE DE MONARCH INDUSTRIES

Les Industries Monarch s'engagent à réparer ou remplacer pour une période de deux ans à compter de la date d'achat, et ceci gratuitement pour l'acheteur initial, toute partie ou pièce jugée défectueuse tant du point de vue matériel que de l'assemblage, ou les deux, après inspection par un centre de service autorisé ou par l'usine des Industries Monarch. Le matériel et les accessoires non fabriqués par les Industries Monarch sont couverts conformément à la garantie du fabricant d'origine. Tous les frais de transport des pièces soumises pour remplacement ou réparation aux termes de la présente garantie seront acquittés par l'acheteur. Pour obtenir un service relevant de cette garantie, contactez le centre de service des Industries Monarch autorisé le plus près. AUCUNE AUTRE GARANTIE NE SERA RECONNUE. TOUTES AUTRES GARANTIES IMPLICITES, Y COMPRIS CELLES RELATIVES À LA VALEUR MARCHANDE OU À D'AUTRES FINS PARCTICULIÈRES, S'APPLIQUENT DURANT LES DEUX ANNÉES QUI SUIVENT LA DATE D'ACHAT ET CONFORMÉMENT AUX LIMITES PRÉVUES PAR LA LOI. LES RESPONSABILITÉS RELEVANT DES DOMMAGES INDIRECTS SONT EXCLUES DES GARANTIES FOURNIES, DANS LA MESURE OÙ LA LOI LE PERMET.
Cette garantie s'ajoute à toute garantie légale.

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MANUAL DEL PROPIETARIO

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⚠ SEGURIDAD **LEA CUIDADOSAMENTE ESTOS MENSAJES DE SEGURIDAD EN ESTE MANUAL Y EN LA BOMBA.**

⚠ CUIDADO

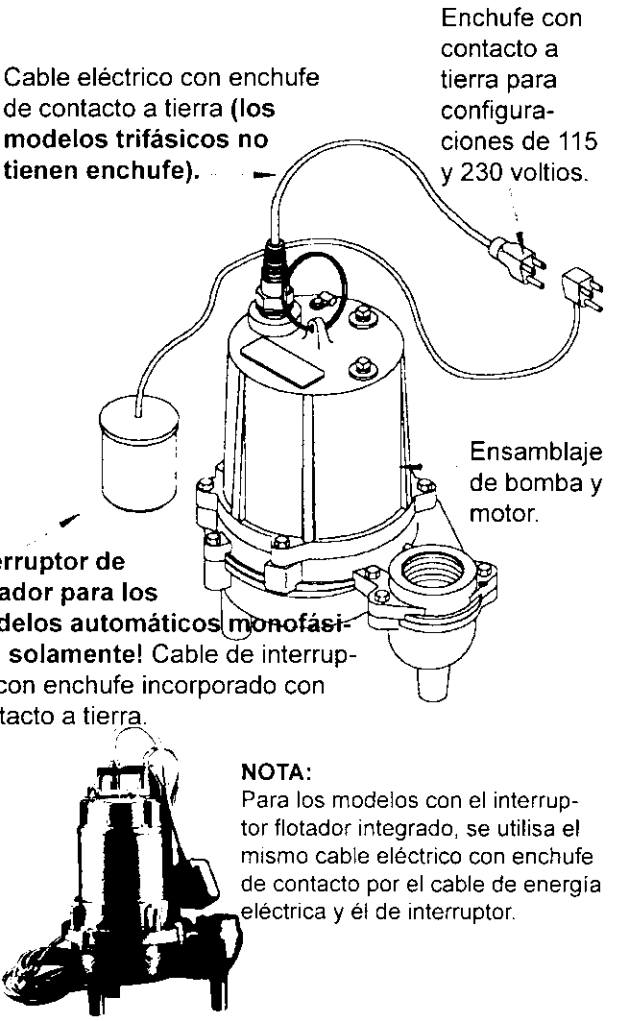
- Revise cuidadosamente las instrucciones antes de usarla.

⚠ AVISO - PRECAUCIONES ELÉCTRICAS

Todo cableado, conexiones eléctricas y sistemas de contacto a tierra deben cumplir con el Código Eléctrico Nacional (NEC) y con cualquier código y ordenanza local. Contrate los servicios de un electricista con licencia.

⚠ AVISO - RIESGO DE DESCARGA ELÉCTRICA

- Haga que un electricista conecte la electricidad al motor.
- Se recomienda se use un circuito protegido por un Interruptor con Falla a Tierra (GFI) con cualquier aparato eléctrico que funcione cerca del agua.



NOTA:
Para los modelos con el interruptor flotador integrado, se utilisa el mismo cable eléctrico con enchufe de contacto por el cable de energía eléctrica y él de interruptor.

- ❑ Se recomienda se use un circuito protegido con interruptor de contacto a tierra (GFI) con todo dispositivo eléctrico que opere en o cerca del agua.
- ❑ Haga que un electricista conecte la electricidad a la bomba.
- ❑ Asegúrese que el voltaje y la frecuencia de la corriente eléctrica concuerden con las especificaciones impresas en la plancha de marca de la bomba
- ❑ Asegúrese que la bomba y el sistema de abastecimiento eléctrico estén debidamente conectados a tierra. Nunca instale ni pruebe una bomba sin el debido contacto a tierra del sistema.
- ❑ Desconecte siempre el enchufe de la fuente de poder antes de manipularla.
- ❑ Este producto (Unidades Monofásicas - 115 y 230 voltios SOLAMENTE) está provisto de un enchufe con tres clavijas para hacer contacto a tierra, conéctelo solamente a un tomacorriente debidamente conectado a tierra. **NUNCA, BAJO NINGUNA CIRCUNSTANCIA, QUITE NI ANULE EL ENCHUFE DE CONTACTO A TIERRA.**
- ❑ Mantenga el enchufe seco, no levante la bomba usando el cable.
- ❑ No se ha investigado su uso para el área de piscinas.

APLICACIÓN PARA EFLUENTES Y DESAGÜES - CAPACIDAD PARA SÓLIDOS HASTA 3/4 PULGADAS Y 2 PULGADAS

- ❑ Estas bombas son para usarse en aplicaciones para efluentes o desagüe sin tratar donde la presión total requerida (incluyendo las pérdidas por fricción) no excedan la capacidad de la bomba. Las bombas del tipo para desagües se pueden usar en aplicaciones efluentes o desagüe sin tratar.
- ❑ Además, no se debe exceder el tamaño máximo de los sólidos . Vea la Fig.1.

REGISTRO DE INSTALACIÓN

Guarde un registro exacto de su instalación para referencias futuras. Asegúrese de registrar la información de la instalación en el área proporcionada enseguida.

Comprada de:_____

Número telefónico: ( )_____

Bomba modelo No. _____

Bomba serie No. _____

Fecha de instalación:_____

Instalada por:_____

Número telefónico: ( )_____

Tamaño del tanque o letrina:_____ Capacidad

Tamaño de descarga de la tubería:_____ Pulgadas

Elevación de la descarga:_____ Pies

TABLA DE CONTENIDO

Advertencias de seguridad, regulatorias y eléctricas ..... En todo el manual

Aplicaciones ..... Página 2

Registros de instalación y tabla de contenido ..... Página 2

Información de instalación y dibujos de instalación típica ..... Páginas 2, 3, 4 y 5

Revisión de encendido y funcionamiento ..... Página 6

Pautas de seguridad y mantenimiento ..... Página 7

Cómo resolver problemas ..... Páginas 7 y 8

Garantía ..... Página 8

RENDIMIENTO

Modelo de la bomba	Capacidad para sólidos pulgadas	H.P.	RPM	Altura total en pies — Flujo en gal.americanos por minuto 5	10	15	20	25	30	35	40	50	60	70	80	90	Max. a válvula cerrada (pies)
Efluente																	
WS30	11/16	1/3	1750	105	90	70	45	15									28
WS50	3/4	1/2	3450	106	90	80	65	53	36	21	6						42
WSV50H	3/4	1/2	3450				84	73	62	48	29						45
WS50H	3/4	1/2	3450		115	107	98	87	78	68	57	30	0				60
WS100H	3/4	1	3450		150	145	140	134	128	122	115	97	76	53	27	0	90
WS102H	2	1	3450			170	152	127	98	75	46						48
Desagüe																	
WS41	7/8	4/10	1750	118	95	70	40	8									26
WS51	1 3/8	1/2	1750	155	120	83	52	14									27
WS52	2	1/2	1750	135	90	47	14										23
WS52H	2	1/2	3450		130	96	66	31									29
WS102	2	1	1750		175	149	118	85	46	16							37
WSV52	2	1/2	1750	112	80	40											18
WSV52H	2	1/2	3450		69	44	19										23

1. ⚠ AVERTENCIA - PRECAUCIONES ELÉCTRICAS

Antes de instalarla, revise los códigos eléctricos y de plomería nacionales y locales. Una bomba hecha para usarse en aplicaciones de tanques sépticos o letrinas **REQUIERE** que el tanque o letrina **ESTÉ VENTILADO DE ACUERDO A LOS CÓDIGOS LOCALES DE PLOMERÍA,** y **NO SE DEBE INSTALAR EN ÁREAS CLASIFICADAS COMO PELIGROSAS DE ACUERDO AL CÓDIGO ELÉCTRICO NACIONAL ANSI/NFPA 70-1990.** "Estas regulaciones son por su propia seguridad y protección".

2. UBICACIÓN:

La bomba debe estar ubicada en un lugar que:

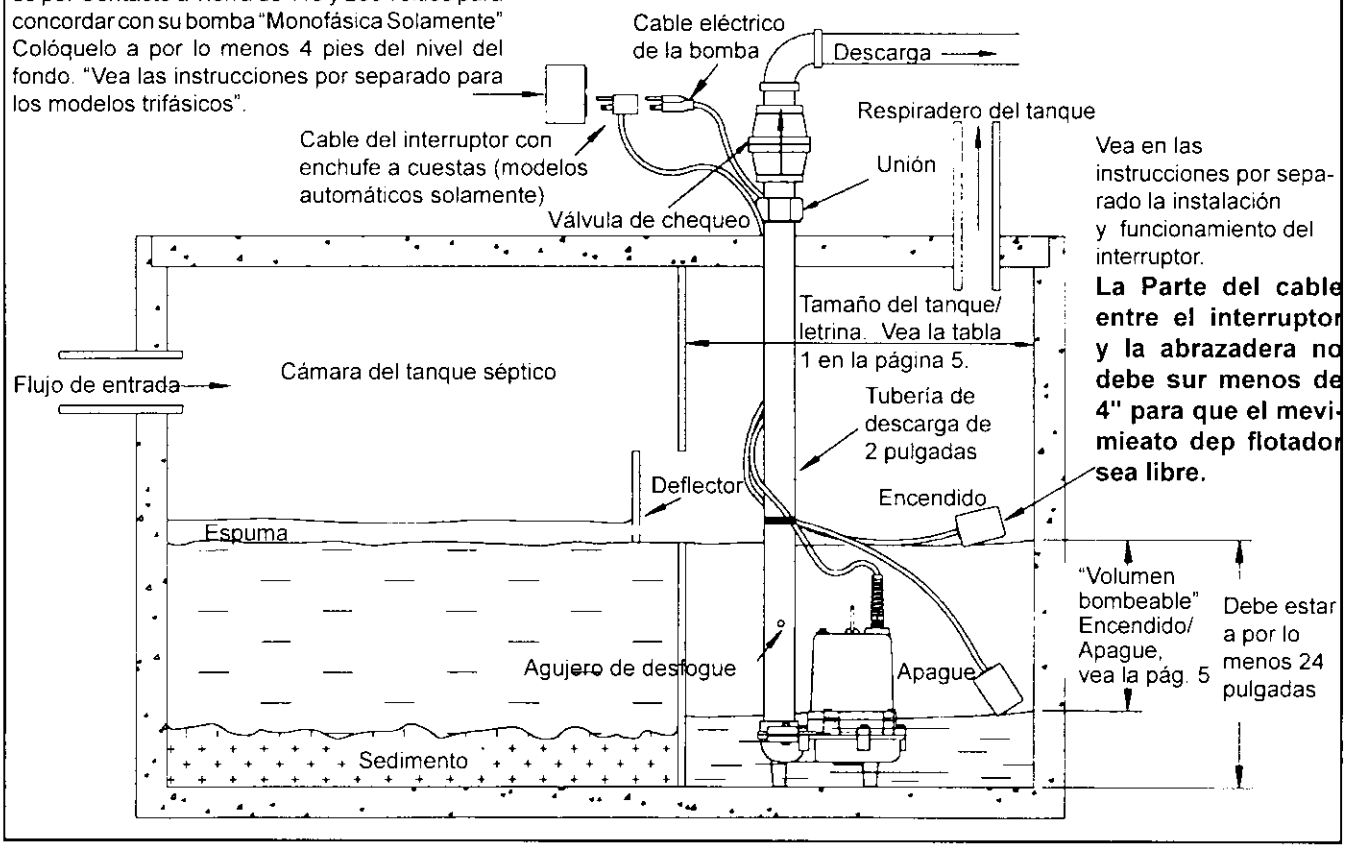
a) Tenga suficiente espacio para darle mantenimiento y que sea del tamaño adecuado "vea la página 5".

b) Esté protegido contra temperaturas congelantes.

c) Necesite lo mínimo de tubería para mantener las pérdidas por fricción al mínimo.

d) Vea en la Fig. #2 a continuación la instalación típica para efluentes/desagües con funcionamiento automático.

Fig. 2
INSTALACIÓN TÍPICA PARA LETRINA DE EFLUENTES/DESAGÜES
Unidades ilustradas: monofásicas automáticas de 115 o 230 voltios



3. PREPARACIÓN Y REQUERIMIENTOS DEL TANQUE SÉPTICO / LETRINA

⚠

AVERTENCIA - PRECAUCIONES ELÉCTRICAS

PUEDE HABER UNA CONDICIÓN DE LETRINA SÉPTICA. SI LA ENTRADA A LA LETRINA FUERA NECESARIA, proporcione primero las debidas precauciones de seguridad de acuerdo a los requerimientos de OSHA, y segundo, NO ENTRE EN LA LETRINA HASTA QUE SE SIGAN ESTRICTAMENTE ESTAS PRECAUCIONES.

- ❑ No fume ni use dispositivos eléctricos que generen chispas ne llamas en una posible letrina séptica (gaseosa).
- ❑ No instale la bomba en un àrea clasificada como peligrosa de acuerdo al código eléctrico nacional ANSI/NFPA 70-1990. Vea las notas de advertencia en la pàgina 2 de este manual.

a) Hermética de gas y debidamente ventilada de acuerdo a los códigos eléctricos nacionales y locales.

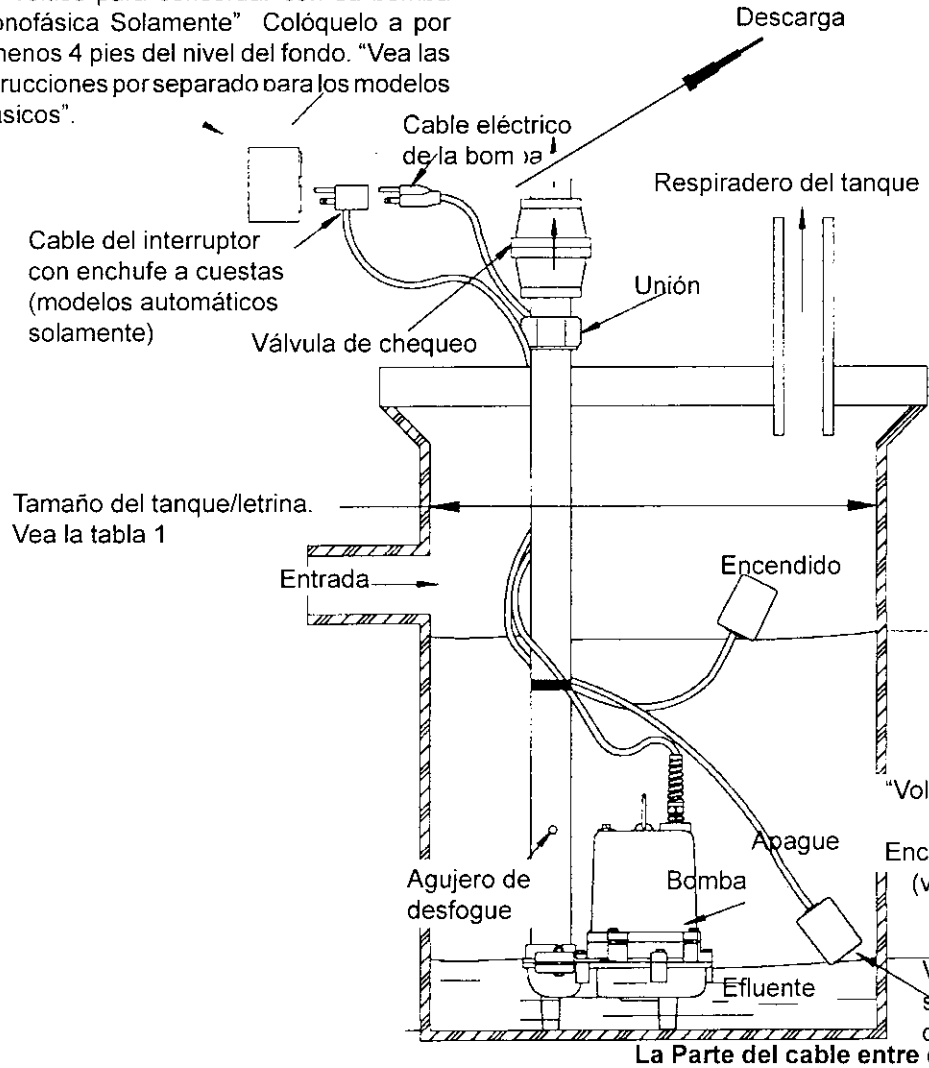
b) Fondo nivelado de la letrina. NO INSTALE LA BOMBA DIRECTAMENTE SOBRE EL FONDO DE LA LETRINA SI ÉSTA NO ES SÓLIDA. Eleve la bomba colocando bloques de ladrillo o concreto debajo de la misma.

c) Asegúrese que la letrina esté limpia y sin clavos, grava, hilos, telas, ropas, desperdicios, etc. antes de instalarla.

Vea la Fig. #3 y la tabla correspondiente a continuación para seleccionar el tamaño o diámetro de la letrina y el largo del cable del interruptor de flotador que permita un "volumen bombeable" suficiente para evitar el corto ciclaje. Asegúrese que la PROFUNDIDAD de la letrina sea suficiente para permitir: 1) el rango de "ENCENDIDO/APAGUE" del interruptor; y 2) el fondo de la letrina debe estar a por lo menos 24 pulgadas del fondo de la entrada de la letrina.

Fig. 3
INSTALACIÓN TÍPICA DE TANQUE/LETRINA PARA EFLUENTES O DESAGÜES
Instalación de unidad monofásica automática de 115 o 230 voltios

Configuración de circuito con Interruptor Automático por Contacto a Tierra de 115 y 230 voltios para concordar con su bomba "Monofásica Solamente" Colóquelo a por lo menos 4 pies del nivel del fondo. "Vea las instrucciones por separado para los modelos trifásicos".



La Parte del cable entre el interruptor y la abrazadera no debe sur menos de 4" para que el mevi-mieato dep flotador sea libre.

TABLA 1

"Volumen bombeable" aproximado (galones) para varias combinaciones de diámetros de letrinas y largos de cable de interruptores de flotador...

Diámetro del tanque/ letrina (pulgadas)	LARGO DEL CABLE DEL INTERRUPTOR DE FLOTADOR (pulgadas)					
	6	8	10	12	14	16
	Escala aprox. del interruptor (pulgadas)					
	10	12	16	18	22	25
	Cantidad (en galones US)					
18	11	13	17	20	-	-
24	20	23	31	35	43	49
30	31	37	49	55	67	76
36	44	53	70	79	97	110
48	78	94	125	141	172	195
60	122	147	196	220	269	305
72	176	211	282	317	387	440

4. PLOMERÍA: TUBERÍAS DE BOMBEO Y DESCARGA

a) Utilice tuberías de acero o de plástico para todas las conexiones entre la bomba y la salida del desagüe. Mantenga el largo de la tubería al mínimo para reducir las pérdidas por fricción. La bomba está equipada con una toma de salida de 2 pulgadas NPT. NO REDUZCA A UN TAMAÑO MENOR.

NOTA: La velocidad de flujo de los líquidos en la línea de descarga de la bomba debe ser de por lo menos dos pies por segundo para llevar el afluente sin atorarse. Esto se logra si el flujo de la bomba es de por lo menos:

21 gpm por una tubería de 2 pulgadas
30 gpm por una tubería de 2 ½ pulgadas
46 gpm por una tubería de 3 pulgadas

⚠ **AVERTENCIA: Algunas regulaciones de ciudades NO permiten la instalación de una bomba con tubería plástica. Revise las regulaciones locales.**

b) Se debe instalar una unión o conexión de desconectado rápido para facilitar la remoción de la bomba, si fuera necesario. SE RECOMIENDA UNA VÁLVULA DE CHEQUEO DE FLUJO COMPLETO DESPUÉS DE LA UNIÓN PARA EVITAR LA CONTRACORRIENTE LUEGO DE CADA CICLO DE BOMBEO.

NOTA: Cuando se usa una válvula de chequeo, taladre un agujero de desfogue de 1/8 o 3/16 de pulgada en la tubería de descarga. Este agujero debe estar por debajo de la línea del suelo dentro de la bomba sellada, y entre la bomba y la válvula de chequeo. (vea las Fig. 2 y 3). "Sin este agujero de desfogue, la bomba se puede bloquear con aire y no bombeará, a pesar que esté funcionando".

5. CÓMO INSTALAR EL INTERRUPTOR DE FLOTADOR: MODELOS DE OPERACIÓN AUTOMÁTICA, SOLAMENTE

a) **Todos los modelos automáticos:** Los modelos monofásicos de 115 y 230 voltios vienen provistos de un interruptor de flotador para instalarlo en la tubería de descarga de la bomba, y necesita calibración final para ajustarse a las necesidades de su sistema.

b) El interruptor de flotador está equipado con un cable y una configuración de enchufe de "a cuestas" de 115 o 230 (dependiendo del modelo de voltaje que usted tenga). El interruptor proporciona un funcionamiento automático de la bomba en aplicaciones de agua, efluentes y desagüe.

⚠ **AVERTENCIA**
- RIESGO DE DESCARGA ELÉCTRICA

c) El interruptor de flotador está empacado por separado dentro de la caja de cartón de la bomba, e incluye las instrucciones de ensamblaje, calibración, funcionamiento y seguridad del interruptor de parte del fabricante. **Siga las instrucciones del fabricante exactamente apra una instalación y funcionamiento debido. La Parte del cable entre el interruptor y la abrazadera no debe sur menos de 4" para que el mevi-mieato dep flotador sea libre.**

6. MODELOS MANUALES: MODELOS MONOFÁSICOS DE 115 Y 230 VAC SOLAMENTE

a) Los modelos manuales monofásicos de 115 o 230 voltios NO INCLUYEN EL INTERRUPTOR DE FLOTADOR.

b) La bomba viene equipada con un cable eléctrico y una configuración de enchufe con contacto a tierra de 115 o 230 (dependiendo del voltaje del modelo que usted tenga).

c) Enchufe o desenchufe el cable eléctrico de la bomba como sea necesario al circuito protegido con interruptor contra contacto a tierra (GFI), o utilícelo con un control aprobado de motor que concuerde con los amperios de la bomba/motor. El control del motor debe ser del tamaño correcto para la bomba, debe estar debidamente instalado y cableado de acuerdo a los códigos y ordenanzas eléctricas nacionales y locales (NEC).

7. MODELOS MANUALES: MODELOS TRIFÁSICOS DE 230, 460 Y 575 VAC

a) Los modelos manuales trifásicos de 230, 460 y 575 voltios NO INCLUYEN EL INTERRUPTOR DE FLOTADOR.

b) La bomba viene equipada con un cable eléctrico trifásico **sin enchuffe** para usarlo con un control aprobado de motor que concuerde con la categoría de amperaje del motor/bomba y con un elemento(s) de sobrecarga seleccionados o calibrados de acuerdo a las instrucciones del fabricante del control.

c) El control del motor trifásico debe ser del tamaño correcto para la bomba, debe estar debidamente instalado y cableado de acuerdo a los códigos y ordenanzas eléctricas nacionales y locales.

REVISIÓN DEL ENCENDIDO Y FUNCIONAMIENTO

8. MODELOS AUTOMÁTICOS (CON INTERRUPTOR DE FLOTADOR) MODELOS MONOFÁSICOS DE 115 Y 230 VAC:

a) Conecte el enchufe "de a cuestas" de tres clavijas del cable del interruptor del flotador a un interruptor con circuito protegido contra contacto a tierra (GFI) de 115 o 230 vac (dependiendo de su modelo).

NO QUITE LA CLAVIJA DE CONTACTO A TIERRA DEL ENCHUFE. NO LO USE CON CABLE DE EXTENSIÓN.

b) Conecte el enchufe de tres clavijas con contacto a tierra del cable de suministro eléctrico al tomacorrientes de "a cuestas" en la parte posterior del enchufe del interruptor. NO QUITE LA CLAVIJA DE CONTACTO A TIERRA DEL ENCHUFE. NO LO USE CON CABLE DE EXTENSIÓN.

c) Llene manualmente el tanque/letrina con agua para revisar el funcionamiento del interruptor. NO LA HAGA FUNCIONAR EN SECO.

d) Asegúrese que el flotador del interruptor cuelgue libremente y que los niveles de "encendido/apague" sean satisfactorios. El flotador del interruptor NO DEBE ESTAR EN CONTACTO CON LOS LADOS NI EL FONDO DEL TANQUE/LETRINA.

e) Haga que su sistema funcione unos cuantos ciclos para asegurar un funcionamiento satisfactorio. Vuelva a colocar la tapa del tanque/letrina y vuelva a revisar que todos los componentes/requerimientos del sistema estén bien.

9. MODELOS MANUALES: MONOFÁSICOS DE 115 Y 230 VAC

a) Llene manualmente el tanque/letrina con agua para revisar el buen funcionamiento de la bomba. NO LA HAGA FUNCIONAR EN SECO.

b) Conecte el enchufe de tres clavijas con contacto a tierra del cable de eléctrico de la bomba a un tomacorrientes con interruptor contra contacto a tierra (GFI) o a un control aprobado del motor. NO QUITE LA CLAVIJA DE CONTACTO A TIERRA DEL ENCHUFE. NO LO USE CON CABLE DE EXTENSIÓN.

c) Haga funcionar su sistema por unos ciclos para asegurarse que su funcionamiento es satisfactorio. Vuelva a colocar la tapa del tanque/letrina y vuelva a verificar que todos los componentes/requerimientos del sistema estén bien.

10. MODELOS MANUALES: TRIFÁSICOS DE 230, 460 Y 575 VAC

a) Llene manualmente el tanque/letrina con agua para verificar el buen funcionamiento de la bomba. NO LA HAGA FUNCIONAR EN SECO.

b) Después de que el cable eléctrico de la bomba haya sido cableado a un control aprobado de motor trifásico, del debido tamaño, y con contacto a tierra, haga funcionar su sistema por unos ciclos para asegurarse que su funcionamiento sea satisfactorio. Vuelva a colocar la tapa del tanque/letrina y vuelva a verificar que todos los componentes/requerimientos del sistema estén bien.

PAUTAS DE SEGURIDAD Y MANTENIMIENTO

11. PAUTAS DE SEGURIDAD

⚠ AVERTENCIA :
RIESGO DE DESCARGA ELÉCTRICA - LESIONES FÍSICAS

a) Use siempre botas de goma cuando tenga que desenchufar la bomba de la fuente de electricidad.

b) Nunca haga ajustes ni revisiones de mantenimiento con el cable eléctrico conectado. Desconecte la bomba de la fuente de electricidad antes de darle CUALQUIER servicio.

c) **NO FUME NI USE DISPOSITIVOS ELÉCTRICOS QUE GENEREN CHISPAS NI LLAMAS EN UNA POSIBLE LETRINA SÉPTICA (GASEOSA).**

d) PUEDE HABER UNA CONDICIÓN DE LETRINA SÉPTICA. SI LA ENTRADA A LA LETRINA FUERA NECESARIA, proporcione primero las debidas precauciones de seguridad de acuerdo a los requerimientos de OSHA, y segundo, NO ENTRE A LA LETRINA HASTA QUE SE SIGAN ESTRICTAMENTE ESTAS PRECAUCIONES.

e) NO QUITE LA PUNTA O CLAVIJA DE CONTACTO A TIERRA DE NINGÚN ENCHUFE ELÉCTRICO O INTERRUPTOR, ya que es su contacto a tierra y está ahí por su seguridad.

12. MANTENIMIENTO: SU BOMBA HA SIDO FABRICADA PARA NO NECESITAR MANTENIMIENTO PERIÓDICO, YA QUE ES COMPLETAMENTE AUTOLUBRICADA. SE RECOMIENDA SE HAGA LA SIGUIENTE REVISIÓN RUTINARIA UNA VEZ AL AÑO, ESPECIALMENTE CUANDO ES UTILIZADA PARA USOS ESPECIALES.

a) Revise los cable de electricidad y los tomacorrientes eléctricos para ver que no estén dañado ni corroídos.

b) Asegúrese que no haya acumulación de fango o sedimentos, ni bloqueo en el tanque o letrina que puedan bloquear la bomba.

c) Levante y baje manualmente el interruptor del flotador para asegurarse que la bomba esté funcionando bien (especialmente cuando es utilizada ocasionalmente).

d) Llene el tanque o letrina manualmente para verificar el buen calibramiento y funcionamiento del interruptor y el sistema de operación.

GUÍA PARA SOLUCIONAR PROBLEMAS

13. GUÍA PARA SOLUCIONAR PROBLEMAS: GUÍA PARA SOLUCIONAR PROBLEMAS: SIGA TODAS LAS PAUTAS, PROCEDIMIENTOS Y ADVERTENCIAS DE SEGURIDAD ANTERIORMENTE IDENTIFICADAS EN ESTE MANUAL ANTES DE IDENTIFICAR Y SOLUCIONAR LOS PROBLEMAS DEL SISTEMA.

PROBLEMA	CAUSA PROBABLE	ACCIÓN CORRECTIVA
El motor no funciona	Fusible quemado	Reemplácelo
	Circuito desconectado	Vuélvalo a conectar
	Enchufe desconectado	Vuélvalo a instalar
	Enchufe corroido	Limpie las puntas o clavijas
	Desconectado por sobrecarga	Deje que la bomba se enfríe, averigüe la causa (propulsor atascado)
	Interruptor defectuoso	Reemplace el interruptor
	Motor defectuoso	Reemplace o repare la bomba
	Posición incorrecta del flotador	Verifique la libertad de movimiento y los niveles operacionales
El motor zumba, pero el flujo es muy poco o **nada**	Propulsor atorado	Desarme y limpie la bomba
	Válvula de chequeo atorada	Saque y limpie la válvula
	Entrada parcialmente bloqueada	Limpie la entrada
	Fuga en la línea	Arregle la fuga
	Propulsor gastado	Reemplace o repare la bomba
	Motor defectuoso	Reemplace o repare la bomba

GUÍA PARA SOLUCIONAR PROBLEMAS		
PROBLEMA	**CAUSA PROBABLE**	**ACCIÓN CORRECTIVA**
Funciona continuamente	Entrada de la bomba bloqueada	Limpie
	Interruptor defectuoso	Reemplace el interruptor
	Obstrucción del flotador	Vuelva a calibrar la posición de la bomba o del flotador
	Válvula de chequeo bloqueada	Saque la válvula, límpiela o reemplácela
La bomba funciona, pero bombea menos agua y a menor presión de lo debido (unidades trifásicas solamente)	La bomba puede estar funcionando en la dirección equivocada. La rotación correcta del propulsor es contra las manecillas del reloj viendo la entrada de succión en la base de la bomba.	⚠ **ADVERTENCIA:** Asegúrese que la bomba esté desenchufada de la electricidad, APAGADA, y luego intercambie cualquiera de las dos PUNTAS DEL MOTOR dentro del control del motor trifásico.

NOTA: Una entrada atorada de la bomba puede confundirse con un interruptor malogrado. Si la bomba funciona continuamente o por largos períodos entre los apagues, revise primero si hay una entrada parcialmente bloqueada.

SERVICIO

14. SERVICIO:

a) Si su bomba requiere servicio, ésta debe ser reparada por un centro de servicio autorizado MONARCH o la garantía será invalidada. Si no hay disponible un centro de servicio, devuelva su bomba al lugar de compra.

b) SU GARANTÍA ES NULA SI...

- ❑ Se ha cortado el cable eléctrico.
- ❑ Se ha usado la bomba para bombear lodo, cemento, brea, productos abrasivos o químicos.
- ❑ Se ha usado la bomba para bombear agua caliente (por encima de los 140 grados Farenheit)
- ❑ Otro centro de servicio no autorizado la ha desmantelado.

15. GARANTÍA:

GARANTÍA LIMITADA DE MONARCH INDUSTRIES

Por dos años a partir de la fecha de compra, Monarch Industries le reemplazará o arreglará, al comprador original, libre de costo, cualquier pieza o piezas que al ser examinadas por cualquiera de los Centros de Servicio Autorizados de Monarch Industries o por cualquier fábrica de Monarch; aparezcan estar defectuosas en materiales, mano de obra o ambos. Los equipos y accesorios no fabricados por Monarch Industries sólo se garantizan por el período de garantía del fabricante original. Todos los costos de transporte de las piezas enviadas para reparar o reemplazar, bajo los términos de esta garantía, deberán ser asumidos por el comprador. Para servicio de garantía, visite el Centro de Servicio Autorizado de Monarch Industries más cercano. NO EXISTE OTRA GARANTÍA EXPRESA. GARANTÍAS IMPLÍCITAS, INCLUYENDO LAS DE COMERCIALIZACIÓN Y ADAPTACIÓN A PROPÓSITOS PARTICULARES, ESTÁN LIMITADAS A DOS AÑOS DESDE LA FECHA DE COMPRA Y DE ACUERDO A LO PERMITIDO POR LA LEY. HASTA DONDE LO PERMITA LA LEY, ESTÁN EXCLUIDAS TODAS LAS RESPONSABILIDADES LEGALES POR DAÑOS RESULTANTES BAJO CUALQUIERA Y TODAS LAS GARANTÍAS. Esta garantía es adicional a cualquier garantía requerida por la ley.

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MONARCH INDUSTRIES

Impreso en Canadá

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APPENDIX L

MYERS WHRS SERIES MANUAL

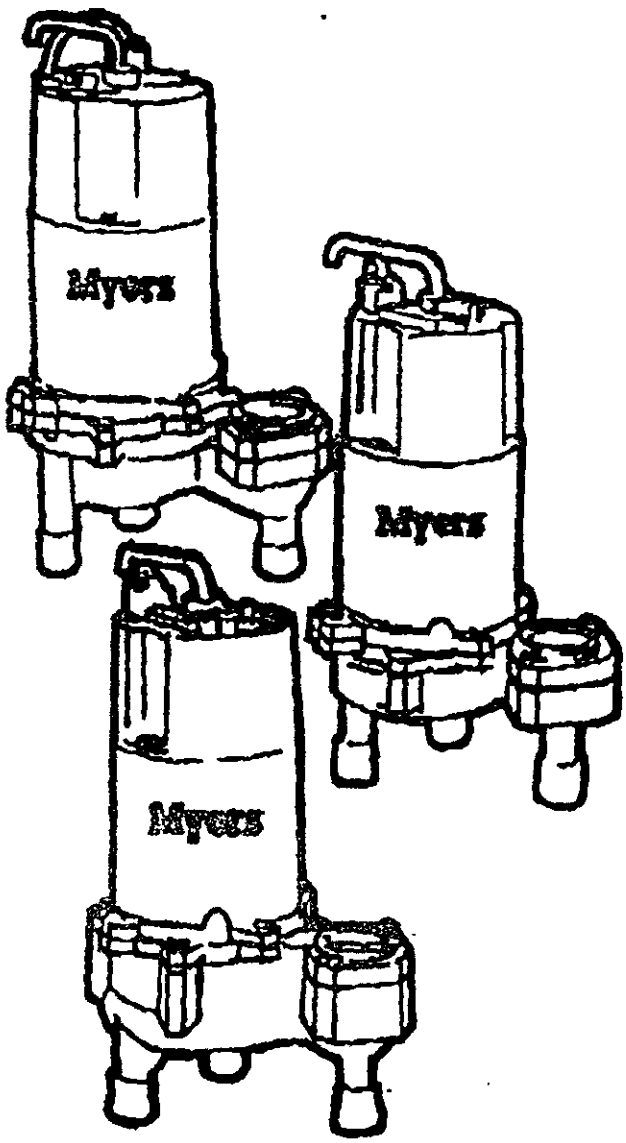
Att Robert

WHRS- ½ H.P.

5100/901

Myers

WHR, WHR-A, WHRH, WHRE
WHR-DS, WHRH-DS & WHRE-DS



6102/302

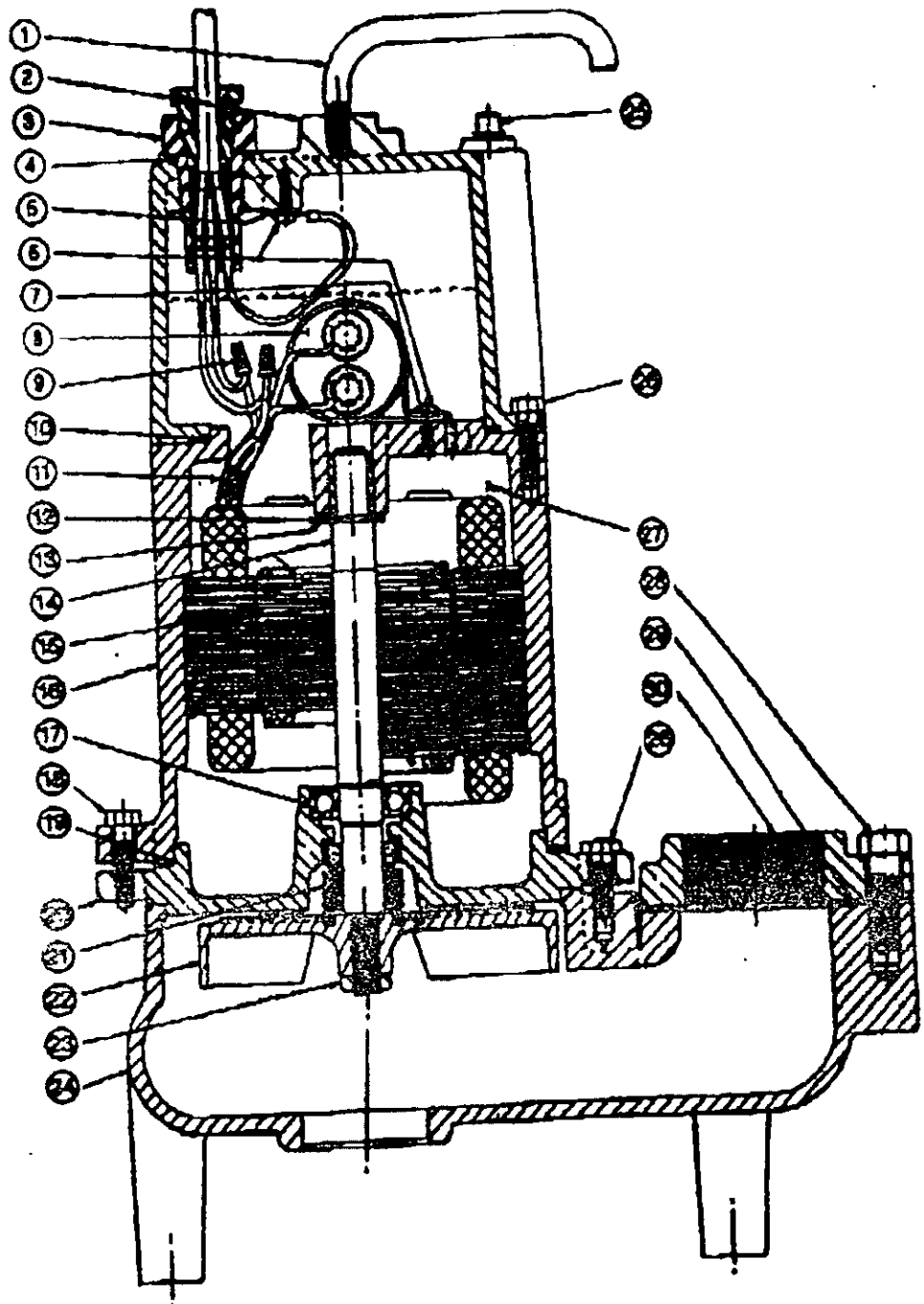
WHR
Parts List

Ref. No.	Description	No. Req'd.	Part Number
1	Handle	1	21949A
2	Housing, Capacitor	1	21643C
3	Fitting & Cord	1	See Chart
4	Ring, "O", 1⅝" x 1¾" x ⅛"	1	5878A18
5	Lockwasher, #10	1	6107A18
6	Screw, Mach., #10-24 x ⅜" 1 Phase / 3 Phase	2 / 1	5434A43
7	Clip, Capacitor Single Phase Only	1	20333A4
8	Capacitor Single Phase Only	1	23633A
9	Connector, Solderless 1 Phase / 3 Phase	2 / 3/8	15781A1
10	Gasket, Tetraseal, 4⅛" x 4⅛" x ⅛"	1	5014A173
11	Tube, Plastic 1 Phase / 3 Phase	1 / 1	[illegible]
12	Washer, Teflon, ⅛" x 1" x ⅜"	1	5030A183
13	Washer, Thrust, ⅛" x 1" x ⅜"	1	5030A173
14	Rotor with Shaft	1	See Chart
	Shaft Only (For All HP Sizes)	1	21853B
—	Housing with Stator	1	See Chart
15	Stator Only	1	See Chart
16	Motor Housing Only	1	21790D

Ref. No.	Description	No. Req'd.	Part Number
17	Bearing, Ball	1	9585A18
18	Screw, Cap. Hex Hd., ¼-18 x 1¾"	4	19100A12
19	Gasket, Tetraseal, 6⅛" x 5⅛" x ⅛"	1	5014A174
20	Plate, Seal Housing	1	21662C
21	Seal, ⅝" Shaft	1	22447A
22	Impeller, Pump	1	See Chart
23	Nut, Hex, ⅜-20 NF	1	19109A79
24	Case, Volute	1	21664D
25	Plug, ¼" Pipe	1	5022A8
26	Screw, Cap. Hex Hd., ¼-18 x 1"	7	19100A29
27	Oil, Transformer (1 Qt. In Can)	.45 Gal.	11009A2
28	Screw, Cap. ⅜-13 x 1¼"	2	19103A43
29	Gasket	1	21661A
30	Plate, Adapter, 2" NPT	1	21660B
—	Plate, Name (Not Stamped) 1 Phase / 3 Phase	1 / 1	[illegible]
—	Screw, Drive	2	5180A4
—	Tip, Crutch, 1⅛" Dia.	3	21819A
—	Eye Bolt, ⅜-16 x 1" Eye	1	21929A2

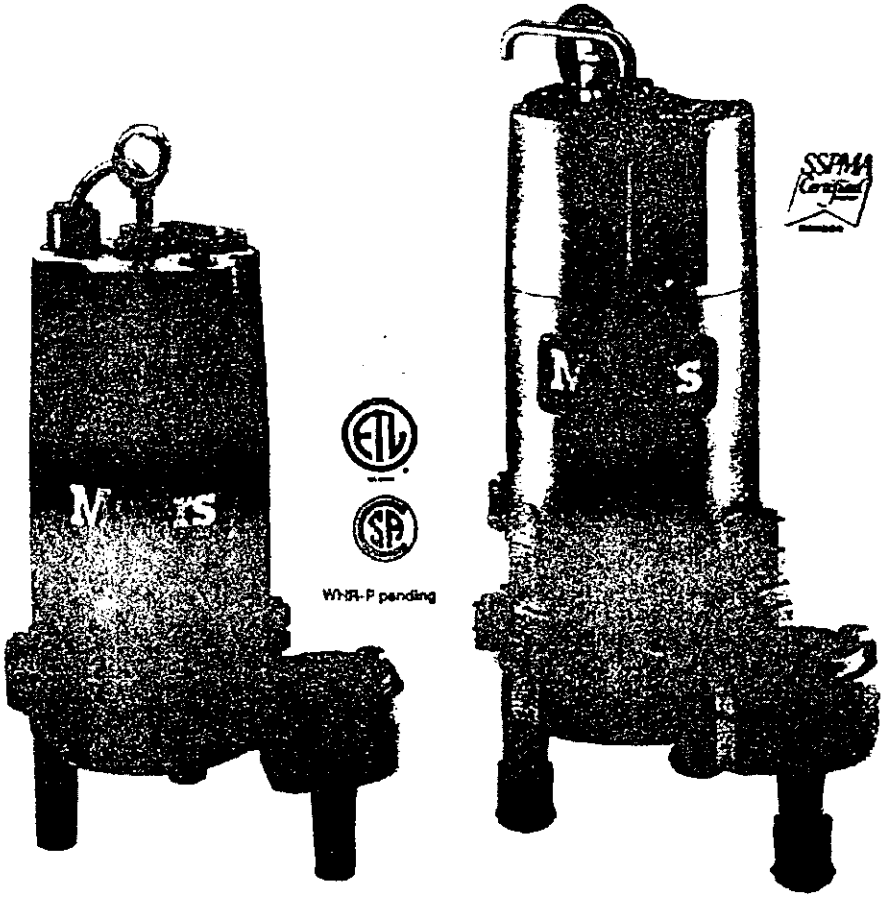
Pump Catalog No.	③ Fitting & Cord	⑧ Rotor with Shaft	Rotor Only	Housing with Stator	⑮ Stator Only	⑯ Impeller
WHR5-110	21533A2	21652B	21654C2008	21790020K	21658C	21663C2
WHR5-21	21533A4	21652B	21654C2008	21790025K	21658C2	21663C2
WHR5-21C	21533A5	21652B	21654C2008	21790025K	21658C2	21663C2
WHR7-21	21533A4	21652B1	21654C2018	21790031K	21658C3	21663C1
WHR7-21C & L/P	21533A5	21652B1	21654C2018	21790031K	21658C3	21663C1
WHR10-21	21533A4	21652B2	21654C2028	21790035K	21658C4	21663C
WHR10-21C & L/P	21533A5	21652B2	21654C2028	21790035K	21658C4	21663C
WHR5-03	21533A6	21652B5	21654C2033	21790040K	21658C5	21663C2
WHR5-23	21533A6	21652B5	21654C2033	21790045K	21658C5	21663C2
WHR5-43	21533A6	21652B5	21654C2033	21790045K	21658C5	21663C2
WHR5-53	21533A6	21652B5	21654C2033	21790050K	21658C7	21663C2
WHR7-03	21533A6	21652B4	21654C2043	21790055K	21658C8	21663C1
WHR7-23	21533A6	21652B4	21654C2043	21790060K	21658C9	21663C1
WHR7-43	21533A6	21652B4	21654C2043	21790060K	21658C9	21663C1
WHR7-53	21533A6	21652B4	21654C2043	21790060K	21658C10	21663C1
WHR10-03	21533A6	21652B3	21654C2053	21790070K	21658C11	21663C
WHR10-23	21533A6	21652B3	21654C2053	21790075K	21658C12	21663C
WHR10-43	21533A6	21652B3	21654C2053	21790075K	21658C12	21663C
WHR10-53	21533A6	21652B3	21654C2053	21790080K	21658C13	21663C

WHR
Parts List



WHR/WHRH and WHRE Waste Handling Sump Pumps

INSTALLATION AND SERVICING INSTRUCTIONS FOR MYERS WHR/WHRH AND WHRE SUBMERSIBLE SUMP PUMPS SINGLE & THREE PHASE POWER SINGLE & DOUBLE SEAL



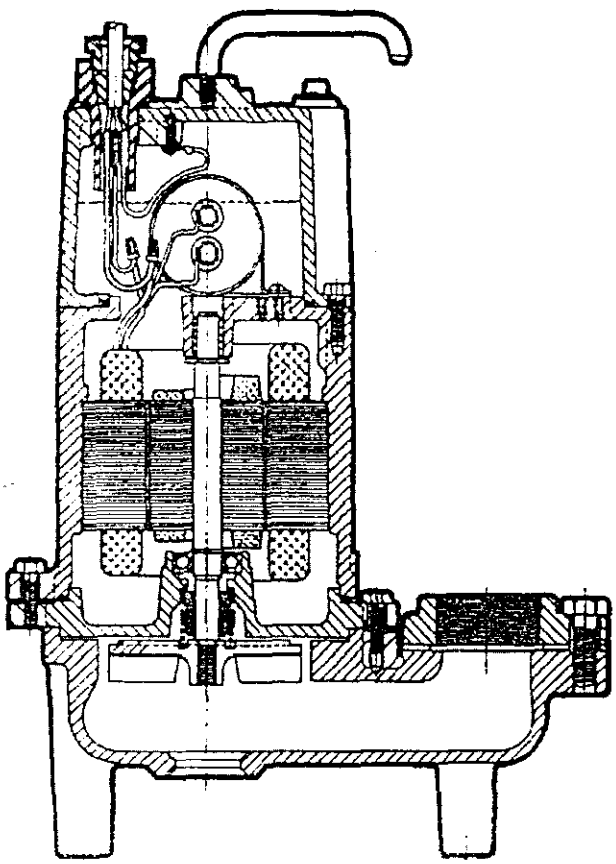
SINGLE SEAL PUMPS

DOUBLE SEAL PUMPS

(Except double seal pumps with seal leak probe)

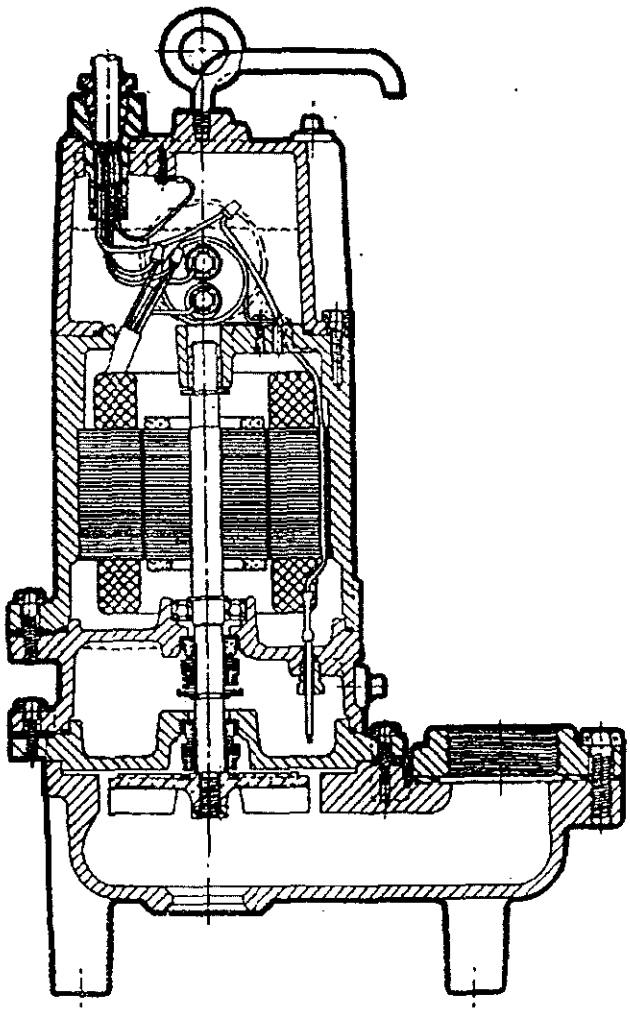
23833A201

TYPICAL SECTIONAL DRAWINGS FOR WHR/WHRH AND WHRE SINGLE AND DOUBLE SEAL WASTE HANDLING PUMPS



SINGLE SEAL
FIG. 1

WHR
WHRH
WHRE



DOUBLE SEAL
FIG. 2

WHR-DS	WHR-DS L/D
WHRH-DS	WHRH-DS L/D
WHRE-DS	WHRE-DS L/D

GENERAL DESCRIPTION AND USES

The WHR and WHRH Series are solids handling pumps that can be used to pump RAW SEWAGE for COMMERCIAL and DOMESTIC use, but are not intended to handle large rags, mop heads or strings. All pumps can be used for normal sump duty where extra capacity is required.

The WHRE Series is for pumping sump water and EFFLUENT from septic tanks only. DO NOT USE FOR RAW SEWAGE.

RECESSED IMPELLERS

All of the pumps are of the recessed impeller type that provides a clear volute passage for solids as no solids pass through the impeller.

All of the pumps listed can be used to pump septic tank EFFLUENT or GROUND sewage as used in some pressure sewer systems.

DESIGN OF PRESSURE SEWER SYSTEMS

MYERS has available complete computer SOFTWARE for designing PRESSURE SEWER SYSTEMS. This gives pipe sizes to use and gives exact flow from any pump or group of pumps in the system when operating simultaneously.

This design DISK for IBM or COMPATIBLE computers is available to engineers on request.

DOUBLE SEAL PUMPS

All double seal models have two seals with an oil chamber between the seals so that seal faces of both lower and upper seals are oil lubricated for longer life and greater protection against water leaking into the motor windings. These double seal units are made with and without a seal leak probe. The leak probe in the oil seal chamber detects any water leakage into the chamber and turns on a red signal light in the control panel. Pumps should be removed from sump and seals replaced after seal light shows in the panel. Control panels must be used for pumps having the seal leak probe.

Double seal pumps without the seal leak probe, should be pulled and seal leak checked in 12 to 18 months.

LEVEL CONTROLS

All pumps must use sealed level control switches for automatic operation. MLC and MFLC controls have sealed mercury switches that are 1 H.P. rated at 230 volts. ALC and AWS-1 controls have sealed mechanical switches that are rated 2 H.P. at 230 volts.

Simplex single phase pumps can be made automatic by attaching MFLC or MLC controls to pump. These switches have a fixed draw off level of 8 to 10" and can be used up to 1 H.P. For higher H.P. ratings two mercury switch (or SMNO) controls with a magnetic starter can be used.

The ALC and AWS-1 controls can be used for simplex single phase pumps with ratings up to 2 H.P.

All duplex systems must use pilot mercury control sensor switches with control box and magnetic starters.

Plug in cords can be used on all the single phase pumps without seal leak detector. This cord has a GROUND pin that plugs into a grounded receptacle. The grounded receptacle cannot be used in the wet sump or basin due to DANGER of current leakage.

Sealed junction boxes must be used in wet sumps or basins to make connections to motor cord. The AWS-1 control also acts as a sealed junction box for connecting power cord to pump cord.

SAFETY WARNING

All pumps single or three phase must have a GROUND WIRE that is connected to a screw in the metal pump housing. This wire goes to the control box and is connected to a good outside GROUND such as a metal water pipe or GROUND STAKE driven at least 6 feet into the ground.

MOTOR TYPES

All single phase pump motors are of the permanent split capacitor type that do not require a start switch or start relay.

Automatic reset overload switches are attached directly to the motor windings.

Three phase pump motors require a magnetic starter with 3 leg overload protection.

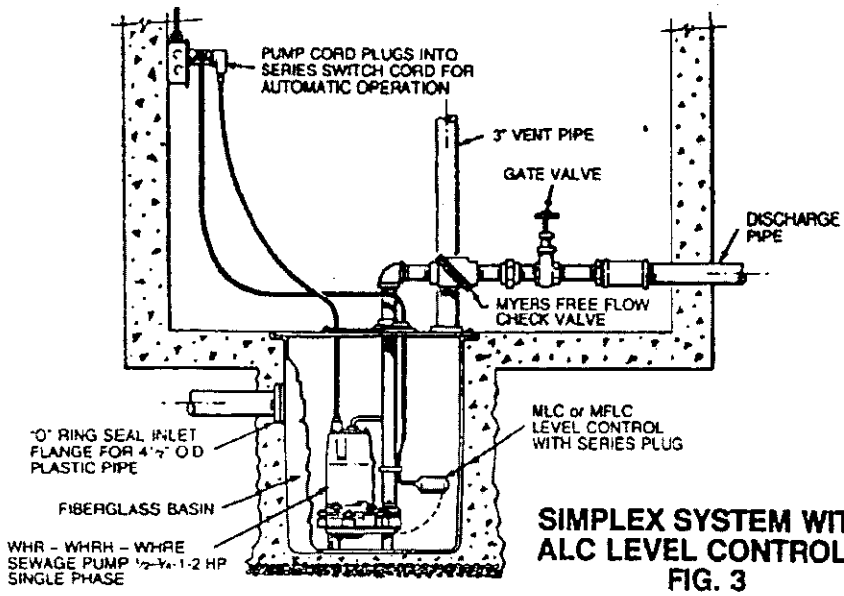
UL and CSA APPROVAL

All manual single seal pumps and double seal pumps without a seal probe sensor are UL listed. All single and double seal pumps are CSA listed. Myers is a SSPMA certified pump member.

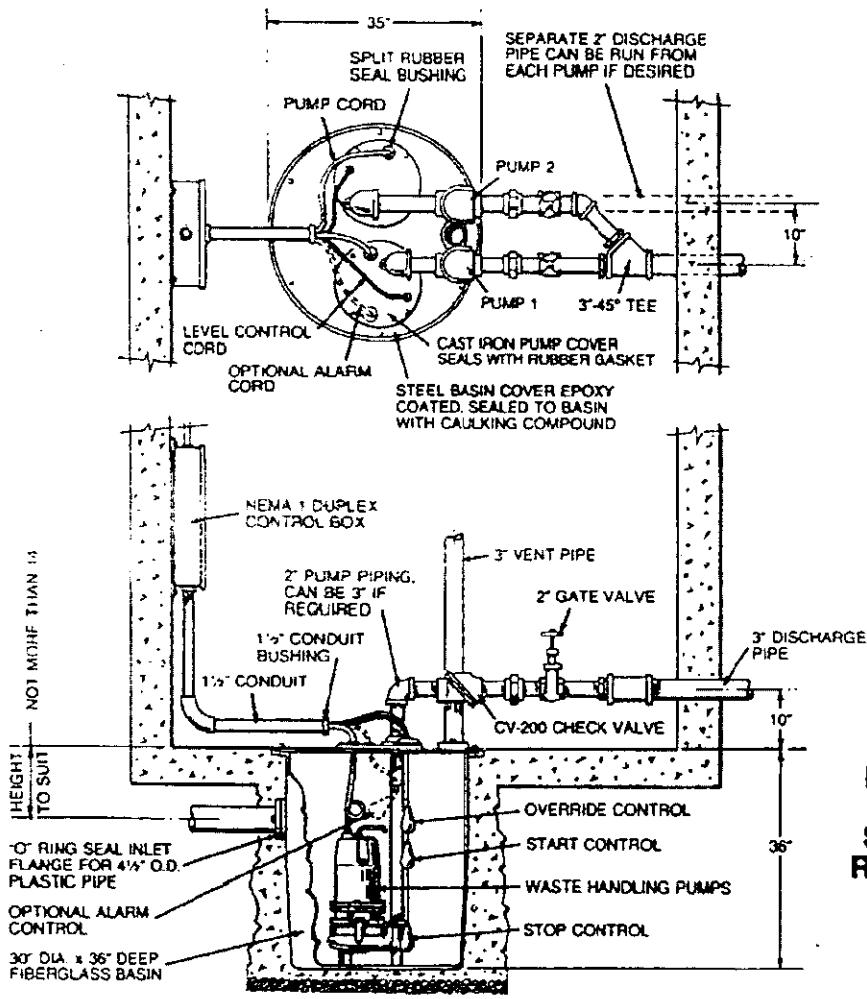
INSTALLATION

Pumps can be installed in inside sealed basins with proper venting for either simplex or duplex systems. SIMPLEX or DUPLEX basin systems are available. See Figs. 3 and 4.

It is not recommended that basins be used for RAW SEWAGE inside the home, but are for use in office buildings and small industrial buildings and factories.



SIMPLEX SYSTEM WITH ALC LEVEL CONTROLS. FIG. 3



DUPLEX SYSTEM WITH MERCURY FLOAT OR SMNO CONTROLS AND REMOTE CONTROL BOX. FIG. 4

Basins can be used inside the home where extra capacity sump pumps are required for water softeners and wash water.

If raw sewage must be pumped in the home use outside basins that connect with pressure sewer mains or gravity sewers, or run to septic tanks.

If an inside basin is used it is usually installed at time of pouring the concrete floor.

Pumps can be installed in a compartment of septic tanks for pumping to pressure sewer mains, gravity sewers, leach fields, or evaporation mounds. See Figs. 5, 6 and 7.

PROPER VENTING FOR BASINS INSTALLED INSIDE

All inside sealed basins must have a 2" or 3" vent pipe installed in accordance with local codes. Sumps for handling softener water, wash or drainage water do not have to be sealed or vented.

Outside basins are usually of fiberglass and from 4 to 8 feet deep and have a sealed cover. Pump is usually installed with a lift out rail system so that pump can be removed without disturbing the discharge piping. The check valve comes out with pump for servicing. Complete LIFT OUT SYSTEMS mounted in fiberglass basins are available to meet customers specifications.

WARNING: Sump basin must be vented in accordance with local plumbing codes. These pumps are not designed for and CANNOT be installed in locations classified as hazardous in accordance with the National Electric Code ANSI/NFPA 70.

PIPING

Pumps are fitted with 2" or 3" female threaded pipe flange. Galvanized or PVC plastic pipe can be used. Plastic pipe is preferred for raw sewage or septic tank effluent.

CHECK VALVES AND SHUT-OFF VALVES

All pumps must have check valves and shut-off valves in the discharge line. Check valves must be flapper type with outside spring or ball type. Shut-off valves can be ball or gate type. Plastic construction for both check or shut-off valves is preferred.

STARTING SIMPLEX SYSTEMS

1. For single phase pumps with MLC or MFLC control, plug cords piggy back into receptacle and run water into sump until pump starts. Allow pump to make several on/off cycles. Leave power cord plugged in.

   If pump runs but does not pump it may be air locked. Unplug cord and crack union in the discharge line then restart pump, this should vent off any trapped air. Re-tighten union.

AIR LOCKING

A sump pump is said to be air locked if water traps in the pump and it cannot get out, thus preventing pump from operating.

ALL MYERS SUMP PUMPS HAVE A SMALL AIR VENT HOLE IN THE IMPELLER CHAMBER TO LET OUT TRAPPED AIR. IF THIS HOLE BECOMES PLUGGED, PUMP MAY AIR LOCK. THIS USUALLY HAPPENS ON PUMPS THAT ARE USED MAINLY IN THE WET SEASONS. IN SUMMER MONTHS, THE PUMP MAY BE TURNED OFF AS SUMP WATER DRIED UP. WHEN PUMP IS TURNED ON AGAIN AND WATER COMES UP IN SUMP, THE AIR WILL TRAP IN PUMP IF NOT VENTED.

AS A SECONDARY PRECAUTION IN INSTALLATIONS OF THIS TYPE – ⅛" HOLE SHOULD BE DRILLED IN THE DISCHARGE PIPE BELOW THE CHECK VALVE. THE CHECK VALVE SHOULD BE 12 TO 18 INCHES ABOVE PUMP DISCHARGE. DO NOT PUT CHECK VALVE DIRECTLY INTO PUMP DISCHARGE OPENING.

In normal sumps where the pump is operating daily, air locking rarely occurs.

2. With 2 "mercury" controls turn on power at the control box and run water into sump. When level gets above top control pump should start and continue to pump until level drops to lower control stopping pump. Run pump through several cycles. If pump runs but does not pump, check air lock as in 1. Leave power on for automatic operation.
3. Where ALC or AWS-1 controls are used plug in cord or turn on power and run water into sump, when level is about half way up on upper weight pump should start and run until level drops until about half the lower weight is above water, stopping pump. Check 1, if pump does not operate properly.

   For all cases if motor does not start when water level is up check for proper plug in or that start switch is on, or if fuse is blown.

   ALWAYS HAVE ELECTRICIAN MAKE ELECTRICAL CHECKS.

STARTING PUMP "WHR-P" (AUTOMATIC) USING MECHANICAL SWITCH WITH SERIES PLUG-SIMPLEX SYSTEM

1. These pumps have a mechanical (mercury-free) float switch with a 20 ft. cord and a 115 volt or 230 volt series piggy-back plug on ½ H.P. with switch mounted to the pump. On ¾ H.P. and 1 H.P., it requires 20 ft. cord and 230 volt only.
2. Plug the switch cord plug into a proper voltage, properly grounded outlet.
3. Plug the pump power cord into the back of the switch cord series plug.
4. Tape the cords to the discharge pipe every 12".
5. Run water into sump until pump starts. Be sure discharge line valve is open.
6. Allow pump to operate through several on/off cycles.
7. If pump does not operate properly, see troubleshooting service chart for remedy.

HOW TO SET CONTROLS AND START DUPLEX SYSTEMS

CONTROL BOX MUST BE USED ON ALL DUPLEX SYSTEMS

1. 4 "mercury" controls are used for duplex systems. Set turn-on control 6" to 8" above pumps. Set turn-off control 8" to 10" above bottom of sump. Set override control 6" to 8" above turn-on control. Set high level alarm control about 6" to 8" above override control. Mark all control cords so that they can be connected correctly in the control box. See Fig. 4.
2. Turn Hand-Off-Auto switches to OFF position and close circuit breaker.
3. Turn both H-O-A switches to the AUTO position and run water into sump. When level floats up and activates the turn-on switch one pump should start and run, pump will continue to run until lower control is exposed stopping pump.
4. Run water into sump again and when level floats up turn-on control, opposite pump will start and run until level drops exposing lower control, stopping pump.
5. Run this test several times to be sure pumps are alternating properly.

LEVEL CONTROL SYSTEMS AVAILABLE

1. Simplex single phase packaged automatic system. This system has the MLC or MFLC mercury float switch attached directly to the pump. This system has a fixed pump-off level of 8" to 10" and is usually used for drainage water and is good up to and including 1 H.P.
2. Simplex single phase pumps can use the ALC or AWS-1 controls which are mounted separate from the pump. These controls can be used up to 2 H.P. motors. See Fig. 3.
3. Simplex pumps can use two "mercury" controls mounted separate from the pump. These controls must be used with a control box and magnetic contactor. These controls can be spaced apart for any draw off level required and can be used for 2 H.P. or larger motors.
4. Duplex pump systems must use only the "mercury" controls with electrical control box. These control boxes mounted remote from the sump tank are generally of plastic construction for best corrosion resistance. See Fig. 4.

MOTOR OVERLOAD PROTECTION

All single phase motors have built-in automatic reset overload switches fastened directly to the motor windings.

All 3 phase motors must be installed with magnetic starters having 3 leg overload protection.

HOW TO SET CONTROLS AND START SIMPLEX SYSTEMS

1. Automatic systems – These systems have the MLC, MFLC, or ALC switches mounted on the pump, so pump is installed in the sump and motor cord is plugged into GROUNDED receptacle. For sealed sump cover, power cord is brought through a split rubber plug in the sump cover.
2. Where 2 "mercury" controls are used the turn-on control is set 3" to 6" above top of motor, and the turn-off control is set about 6" to 8" above bottom of sump. If a high level alarm control is used it is set about 6" above upper control. If sump depth will not allow these settings closer spacing can be used.
3. Where ALC or AWS-1 controls are used the DISPLACEMENT WEIGHTS are set so that turn-on weight is 4" to 6" above top of motor and lower weight is set about 6" above sump bottom.
4. Repeat this operation with one pump off which will duplicate a failed pump condition. When the level reaches the override control the pump that is turned on should start and run and pump down sump level.
5. To check high level alarm, again turn both switches to OFF and fill sump until level is above the alarm control. Turn switches to Auto position and ALARM BUZZER should sound and alarm light should come on. When level drops below the alarm control buzzer should stop.
6. If pumps operate as described then set both H-O-A to Auto and pumps are ready to operate automatically.
7. If pumps do not operate properly then check as described for simplex systems. See page 13.

CAUTION — NEVER WORK ON PUMPS OR CONTROL BOXES UNTIL CIRCUIT BREAKERS ARE TURNED OFF.

Always have a qualified ELECTRICIAN make electrical connections and service checks.

SPECIAL INSTRUCTIONS FOR THREE PHASE PUMPS

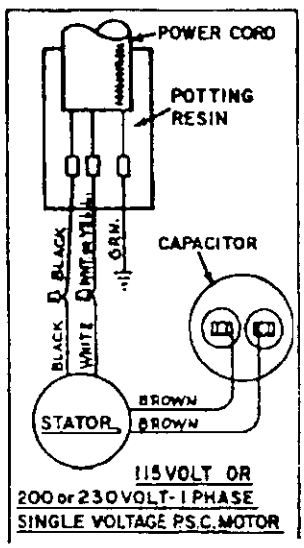
1. F. E. Myers recommends three phase pumps to be installed by qualified personnel. CAUTION: Risk of electric shock. Do not remove cord and strain relief. Do not connect conduit to pump.
2. Three phase pumps are always installed with control boxes having magnetic starters with 3 leg overload protection. DO NOT TRY TO RUN THREE PHASE PUMPS DIRECTLY ACROSS THE LINE.
3. To Connect Pump: Run wire from pump to the bottom of control box or appropriate junction box suitable for enclosing splice connections. A hole must be cut into the control box for the wires. With power to control box off, connect green (ground) line to ground lug. Connect black (power) wires to power lead terminals. Make sure that all wires are inside control box and not in a position to be pinched or shorted when the door is closed. See wiring diagrams, page 8.
4. All three phase motors can run either direction. ROTATION can be changed by interchanging any two line leads at magnetic starter. BE SURE CIRCUIT BREAKER IS OFF BEFORE MAKING THIS CHANGE.

   To find if rotation is correct operate pumps and check delivery operation. If flow and head is low (refer to pump curves shown in this manual) the rotation is wrong. With duplex pumps check operation of both pumps.
5. All pump impellers either single or three phase must turn counterclockwise when looking into pump inlet. If uncertain of rotation, TURN OFF POWER and lift pump from basin with cord connected and lay pump on side so impeller can be seen. Turn on power and start pump using hand position of H-O-A switch. Turn on and off fast so that coast of impeller can be seen. NEVER PUT HAND OR FINGERS ON THE IMPELLER. Interchange any two line leads at the magnetic starter to change rotation.

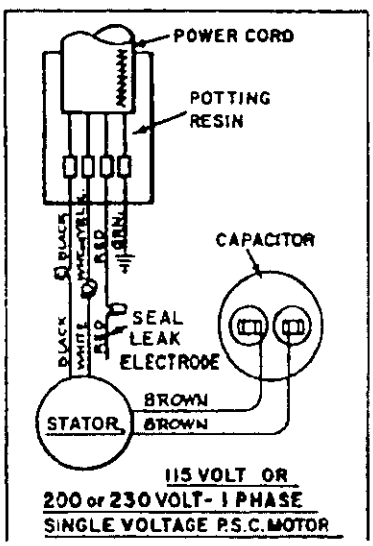
WIRING DIAGRAMS SINGLE PHASE MOTORS

SINGLE PHASE PUMPS

WARNING – Risk of electric shock. This pump is supplied with a grounding conductor and grounding-type attachment plug. To reduce the risk of electric shock, be certain that it is connected only to a properly grounded, grounding-type receptacle.



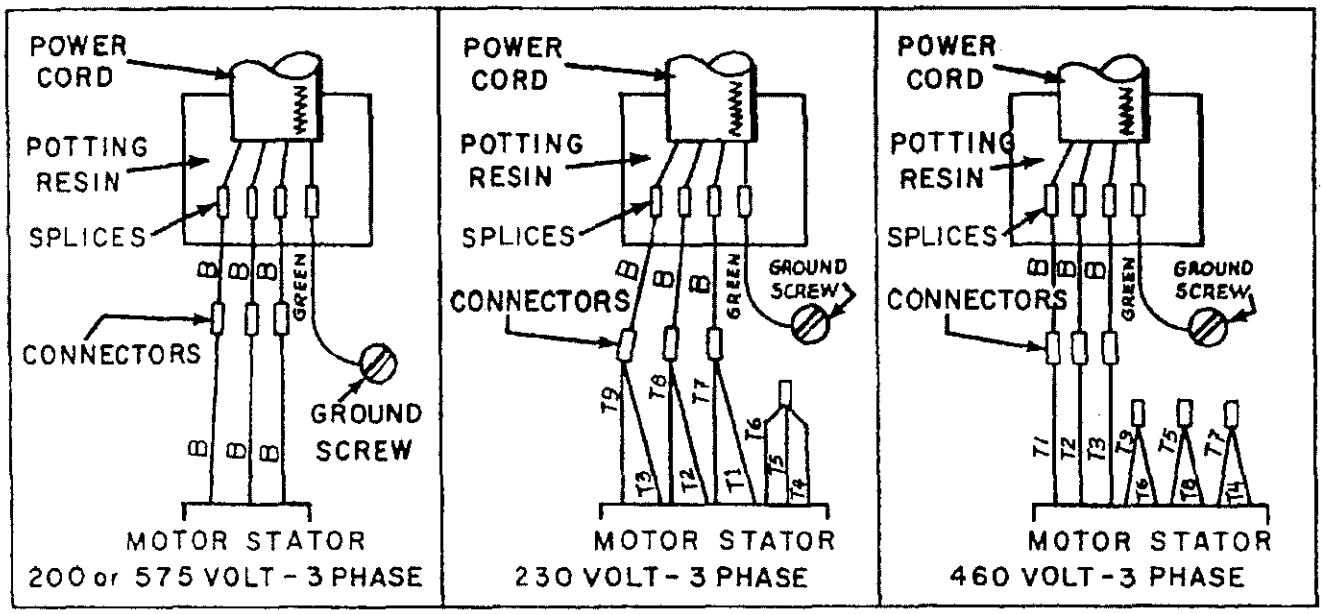
SINGLE SEAL PUMPS AND DOUBLE SEAL PUMPS WITHOUT SEAL LEAK PROBE



DOUBLE SEAL PUMPS WITH SEAL LEAK PROBE

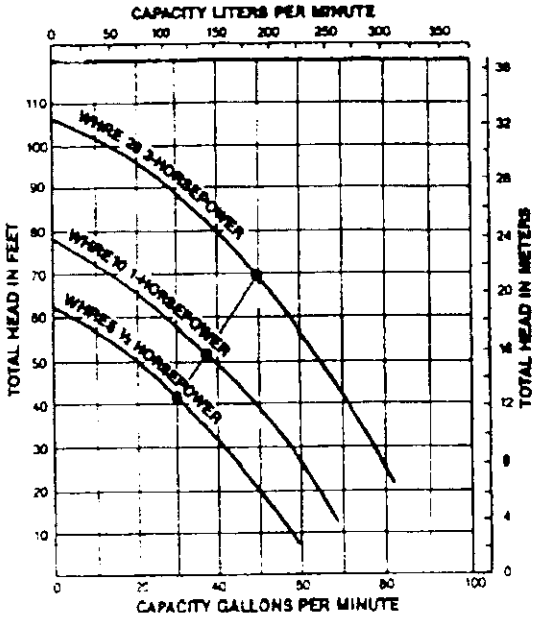
(RED CONDUCTOR IN POWER CORD IS FOR SEAL LEAK PROBE)

WIRING DIAGRAMS FOR 3 PHASE MOTORS

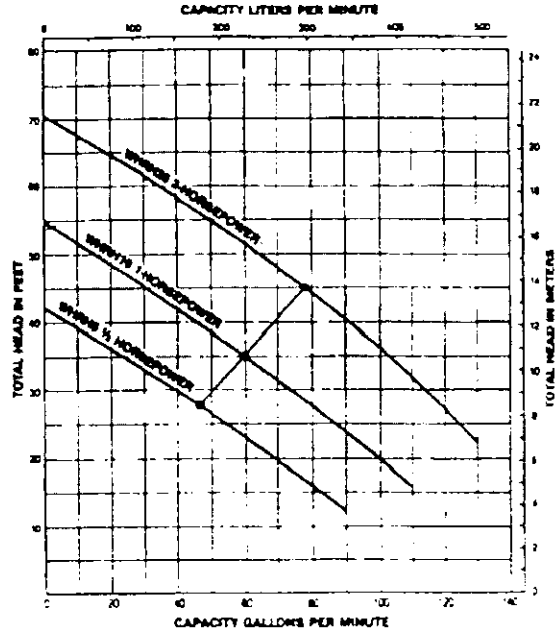


FOR SINGLE SEAL PUMPS AND DOUBLE SEAL PUMPS WITHOUT SEAL LEAK PROBE

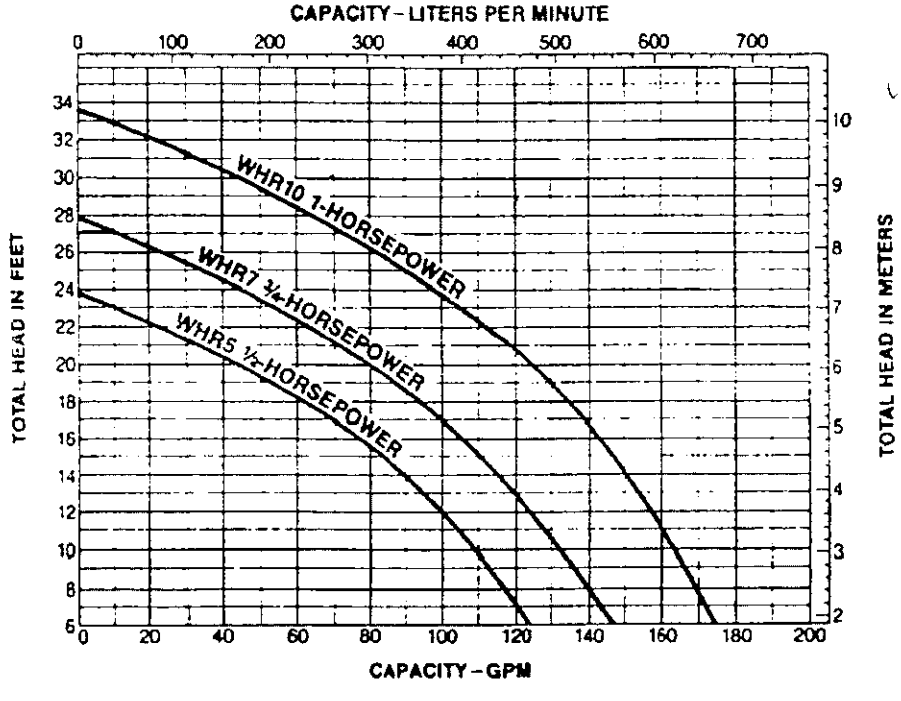
PERFORMANCE CURVES



PERFORMANCE CURVE
WHRE SERIES EFFLUENT PUMPS



PERFORMANCE CURVE
WHRH SERIES WASTE HANDLING PUMPS



PERFORMANCE CURVE
WHR SERIES WASTE HANDLING PUMPS

FIG. 5 PUMP IN SEPARATE TANK, PUMPING TO SEEPAGE MOUND

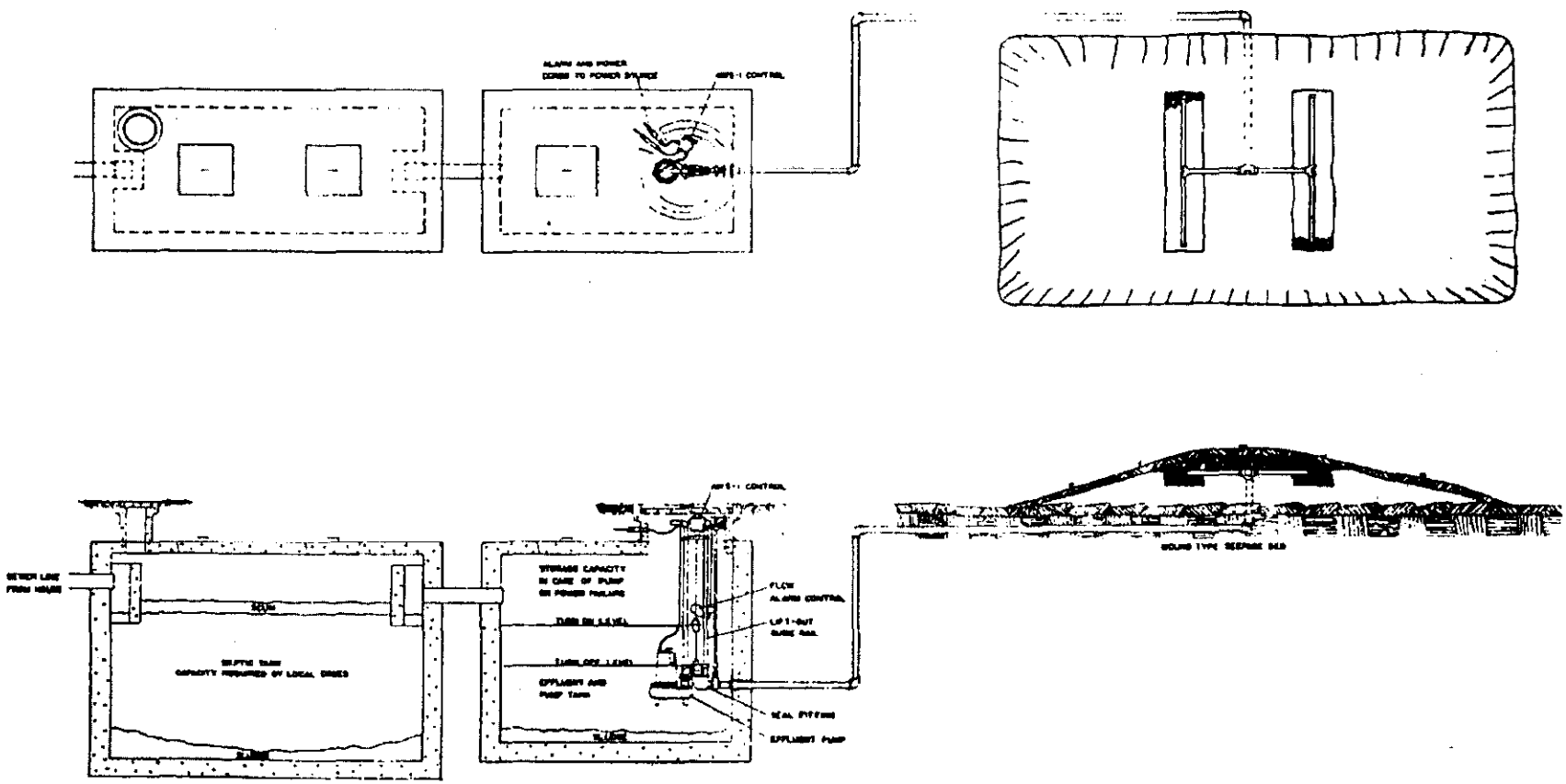


FIG. 5

FIG. 6

FIG. 6 PUMP INSTALLED IN FIBERGLASS BASIN AT OUTLET OF SEPTIC TANK USED WHEN PUMPING INTO PRESSURIZED SEWER MAIN OR LEACH FIELD

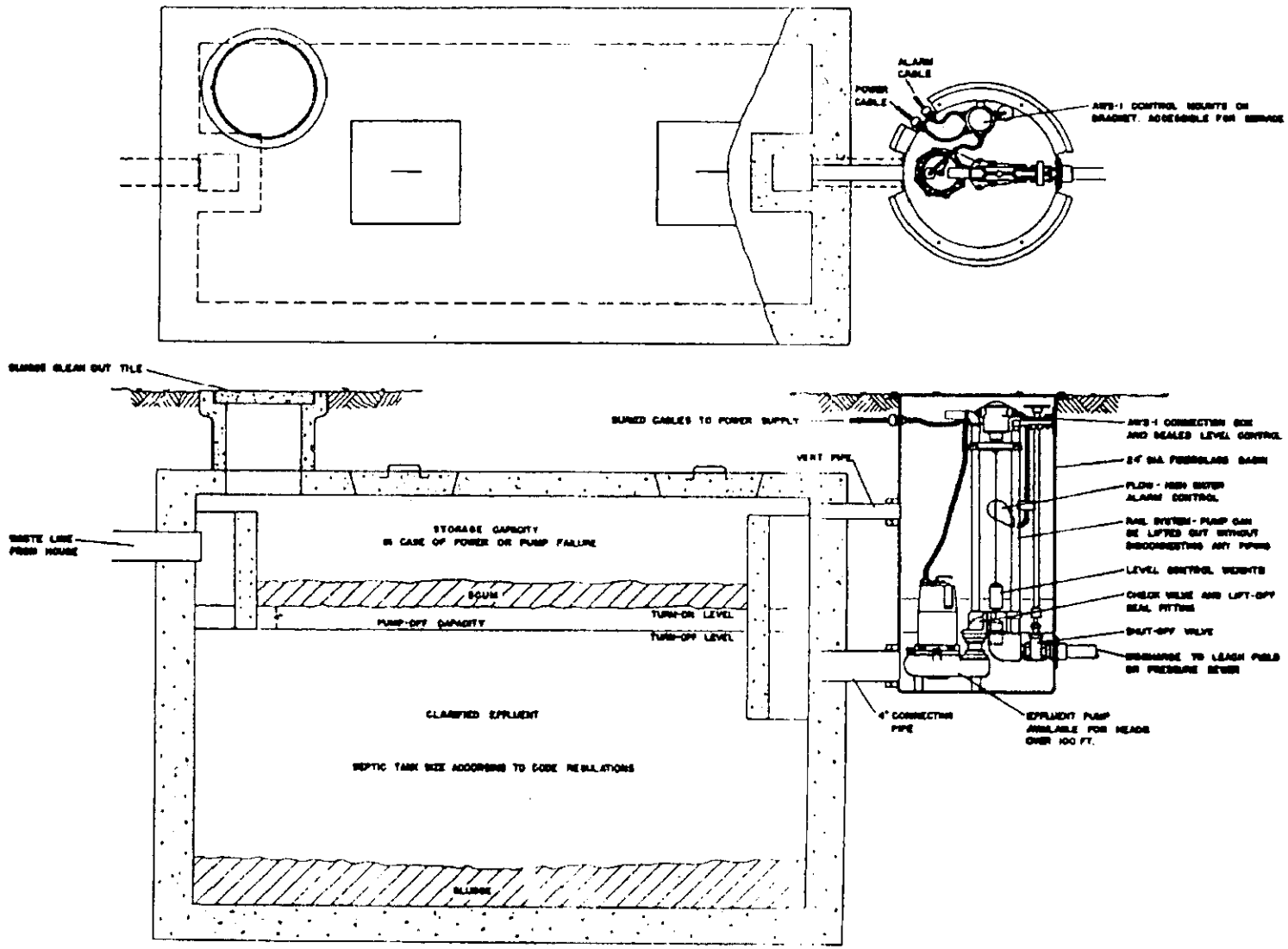


FIG. 7 PUMP AND CONTROLS INSTALLED DIRECTLY IN SEPTIC TANK USED WHEN PUMPING INTO PRESSURIZED MAIN OR LEACH FIELD

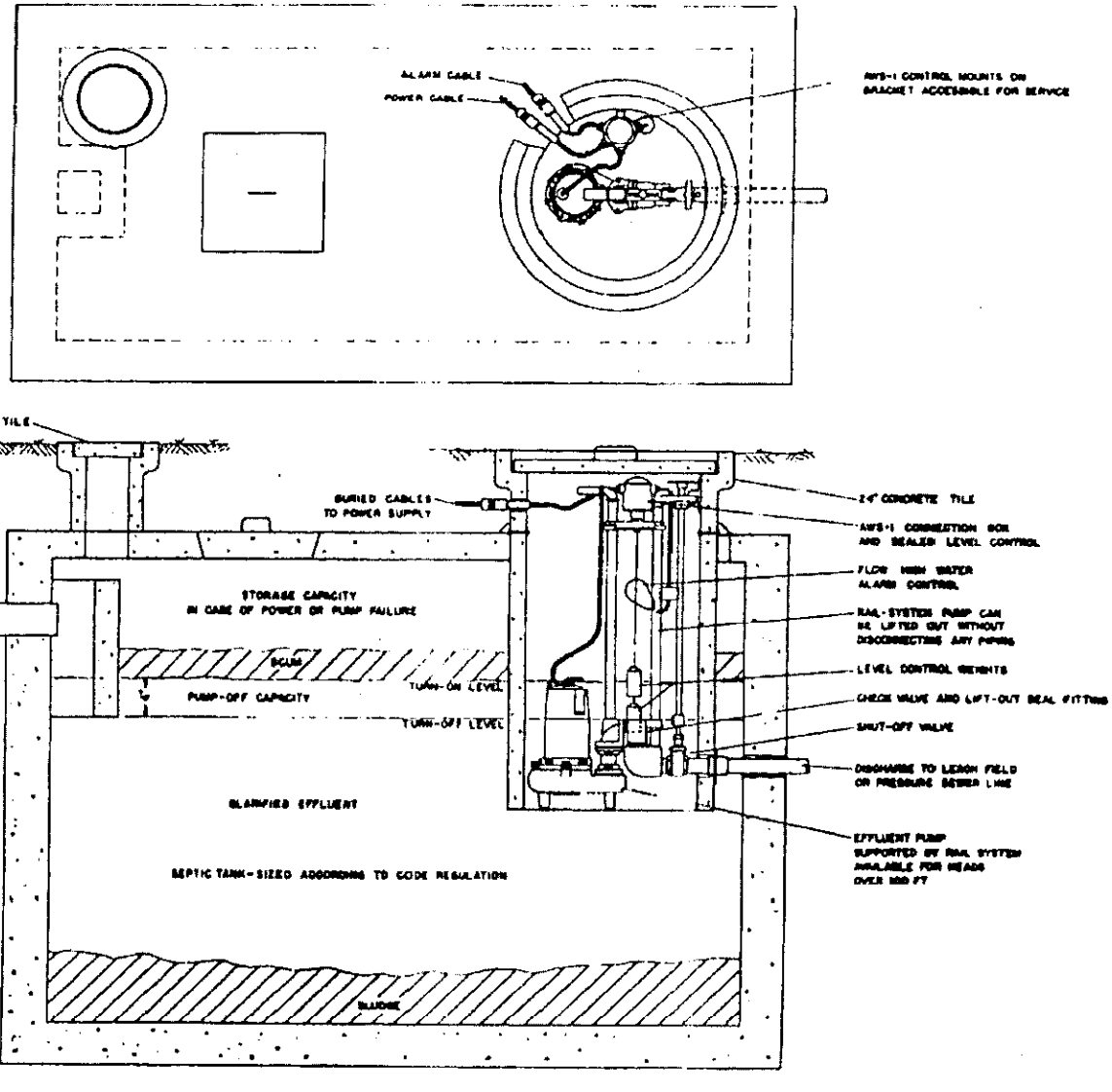


FIG. 7

POINTS TO CHECK IF PUMP DOES NOT RUN OR DOES NOT RUN PROPERLY

1. Pump does not run or start when water is up in sump.
   a. Check for blown fuse or tripped circuit breaker.
   b. Check for defective level switch.
   c. Where control panel is used be sure H-O-A switch is in the Auto position. Turn switch to the HAND position and if pump runs then trouble is in the automatic electrical system. Have ELECTRICIAN make electrical checks.
   d. Check for burned out motor. Occasionally lightning can damage a motor even with lightning protection.
   e. Where plug-in cords are used be sure contact blades are clean. DO NOT USE PLUG-IN CORDS INSIDE A SUMP OR WET WELL.
2. Pump runs but does not deliver flow.
   a. Check for air lock. Start and stop pump several times if this does not help it may be necessary to loosen a union in the discharge line to relieve air lock.
   b. Check valve may be installed backward. Check flow arrow on valve body. Check shut-off valve it may be closed.
   c. Check vertical elevation, it may be higher than pump can develop. (See pump curve.)
   d. Pump inlet may be plugged with a rag or trash. Remove pump to check.
   e. If pump is three phase be sure pump rotation is correct. (See instructions for checking rotation.)
   f. Level control ball or weight may be stuck on side of basin. Trash may be stuck on ball preventing it from floating up.

CAUTION: ALWAYS UN-PLUG CORD OR TURN OFF CIRCUIT BREAKER BEFORE DOING ANY WORK ON THE PUMP. If control panel is remote from pump, disconnect lead wires to motor so that someone cannot turn the circuit breaker back on. If motor is three phase mark the leads so they can be replaced in same order.

DISMANTLING PUMP FOR REPLACEMENT OF PARTS

Clean pump thoroughly. Knock off all scale and deposits. Use sandblast if possible. Submerge complete unit in Clorox solution for one hour before taking apart.

TO REPLACE CAPACITORS ONLY

The motors on all WHR, WHRH and WHRE series single phase pumps are of the permanent split capacitor type, so have no relays or starting switch, and have only a starting capacitor that is in the circuit for both starting and running conditions.

1. Remove oil fill plug in top of motor and pour out oil. Fig. 8
2. Remove bolts from capacitor housing and bump housing with plastic hammer to loosen. Fig. 9
3. Lift housing and disconnect motor leads and capacitor wires. Fig. 10
4. Remove capacitor clamp and slide out capacitor. Replace with new capacitor and re-connect. Fig. 11.

   Wiring connections are given in these instructions.
5. Replace capacitor housing, be sure rubber seal ring is in place. Fig. 12.
6. Refill motor with Myers submersible motor oil. DON'T OVER FILL WITH OIL. OIL LEVEL SHOULD BE ONE INCH FROM TOP OF CASTING. Fig. 13.
7. Be sure pump turns free before plugging into power. Turn pump on side and turn impeller, using screwdriver in slotted shaft.

   Plug pump into receptacle to test operation. Pump must run quiet and free of vibration.



FIG. 8

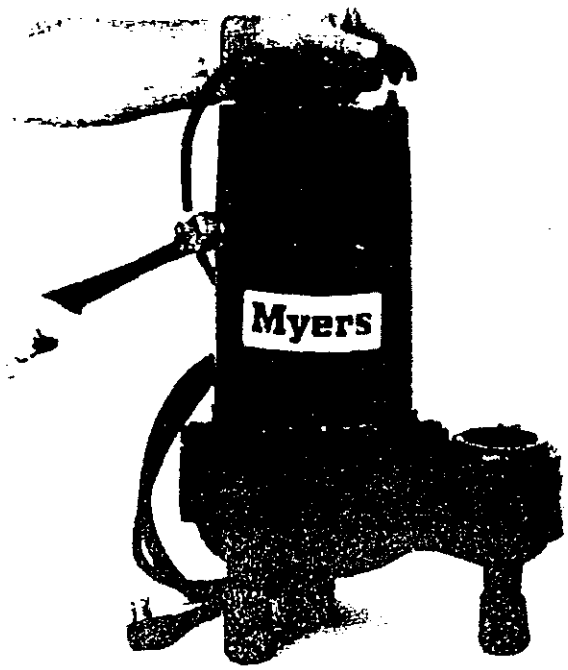


FIG. 9

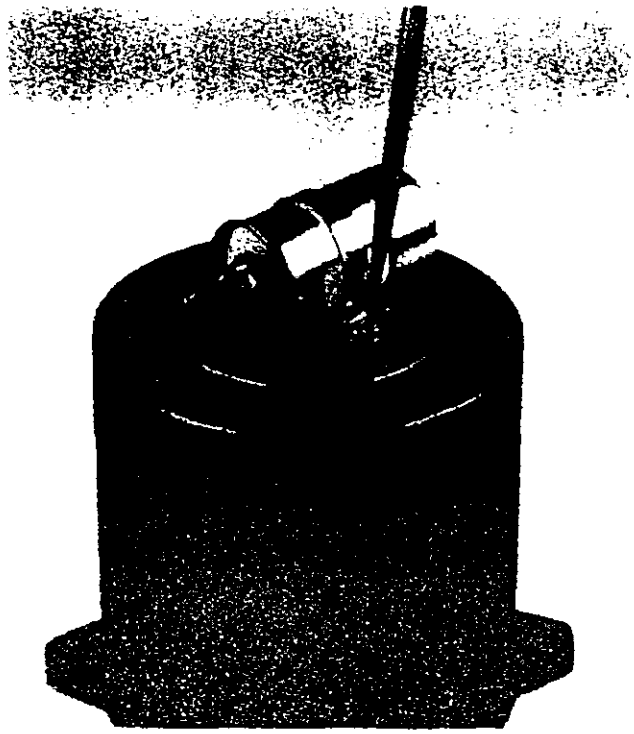


FIG. 11

TO REPLACE POWER CORD ONLY

1. Remove capacitor housing as described above. Disconnect cord leads from motor and remove ground screw.
2. Unscrew cord bushing and remove from housing. Fig. 14.
3. Replace with new fitting and cord, be sure "O" ring seal is in place. Fig. 14.
4. Replace ground screw and re-connect motor wires. Wiring diagram is given in these instructions.



FIG. 10

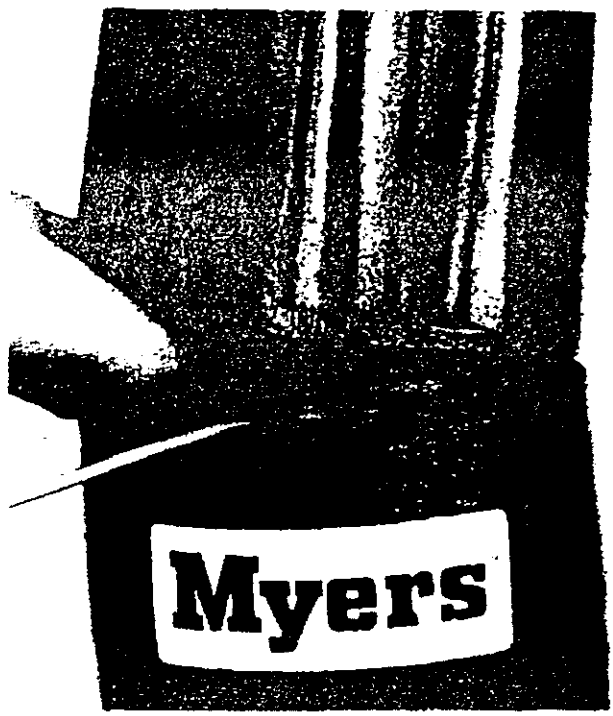


FIG. 12

5. Replace capacitor housing and refill motor with Myers submersible oil. See Fig. 13 for oil level. One inch from top of casting.

COMPLETELY DISMANTLE PUMP TO REPLACE MOTOR STATOR AND SEAL

1. Pour oil from motor and remove capacitor housing as described above.
2. Remove bolts from motor housing only. Do not remove bolts that hold motor plate to volute case. Fig. 15.
3. Lift off motor housing, pry between ears to loosen. Fig. 16.
4. Remove case holding bolts and lift out rotating unit. Pry between ears to loosen. Fig. 17.
5. Hold rotor and unscrew impeller locking nut. Turn counter-clockwise as thread is right hand. Fig. 18.
6. Unscrew impeller, turn counter-clockwise to loosen. Fig. 19.
7. Pry off seal with screwdrivers. It is not important if seal is damaged, as it must be replaced. Replace both parts of seal, never one or the other. Fig. 20.
8. Bump shaft on end with plastic hammer to push ball bearing from lower motor plate. Fig. 21.
9. Clean seal cavity thoroughly before replacing ceramic seal. Use grease on rubber cup of seat and push into housing, use plastic rod to push into place. Clean seal face to remove any speck of dirt, and use light oil on face before installing bellows part of seal. Fig. 22.
10. If necessary to replace ball bearing, press off in arbor press. Use strips of metal between bearing and rotor to press off. Fig. 23. Always press on inner race of bearing when replacing.

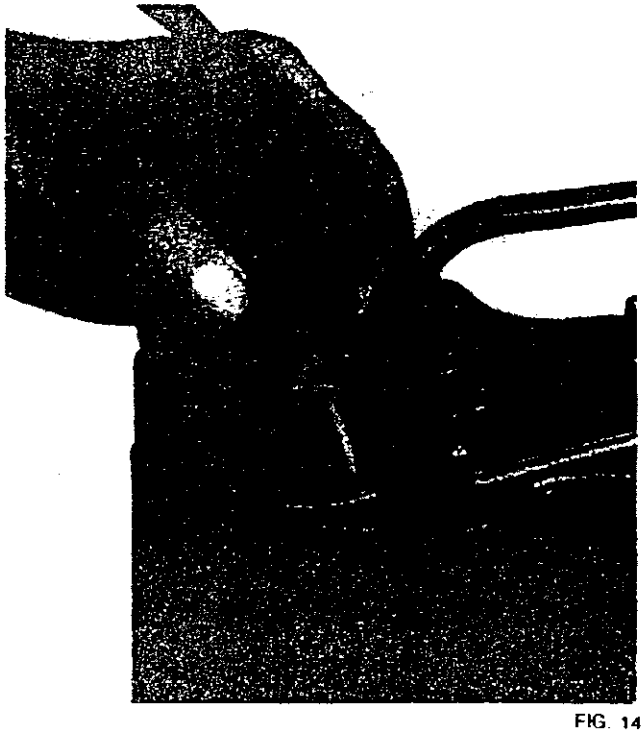


FIG. 14

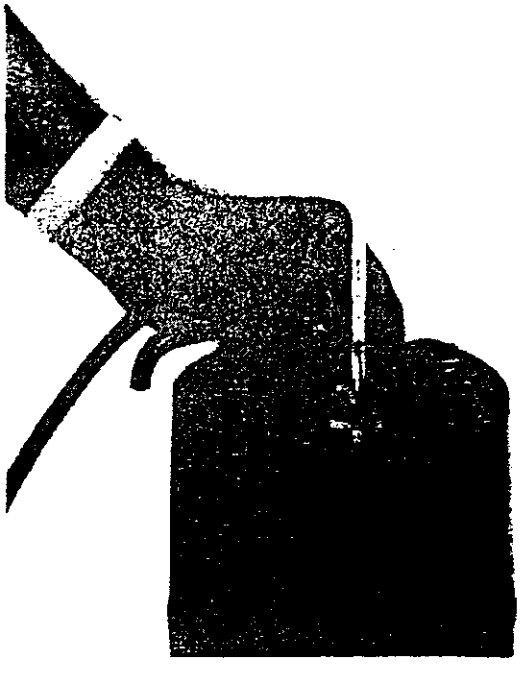


FIG. 13

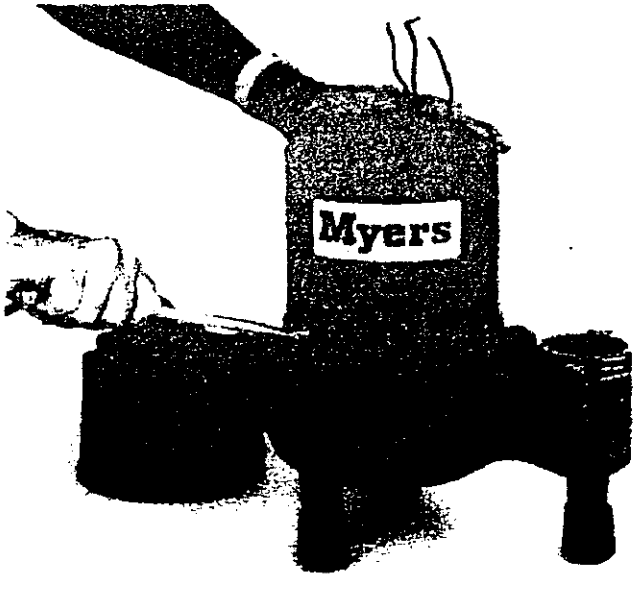


FIG. 15

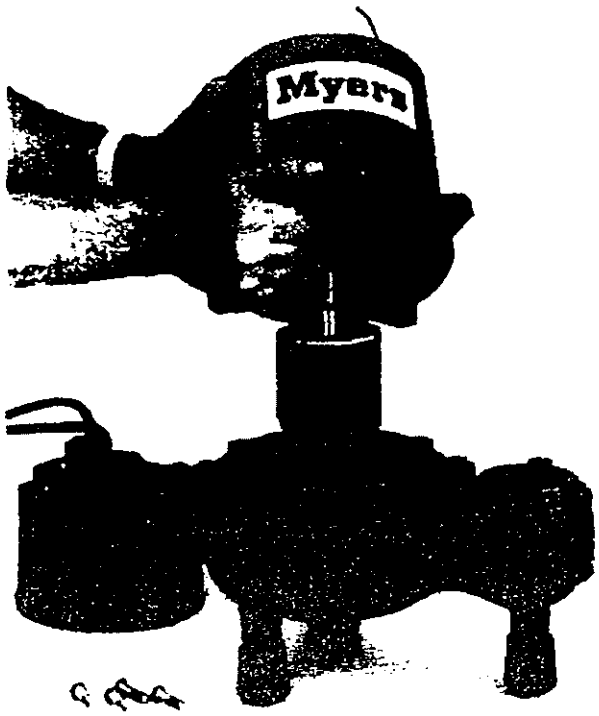


FIG. 16



FIG. 18

11. If necessary to replace motor stator, use new housing with stator pressed in.

    Both housing and stator must be replaced as a unit, as stator is pressed in at factory and is not to be replaced in the field. Fig. 24.

12. In reassembly, be sure rubber seal ring and thrust washer are in place as shown. Fig. 25.

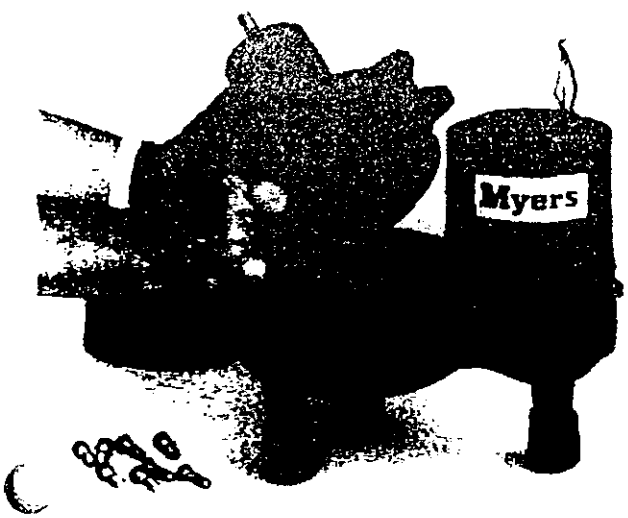


FIG. 17



FIG. 19

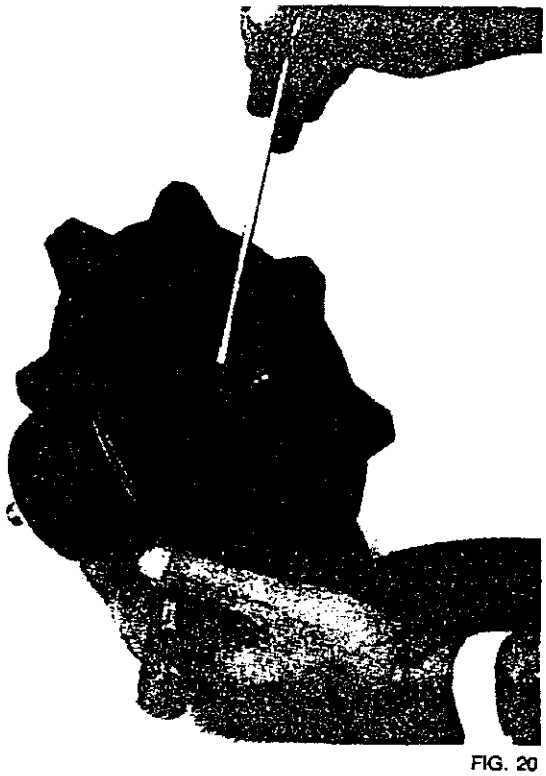


FIG. 20

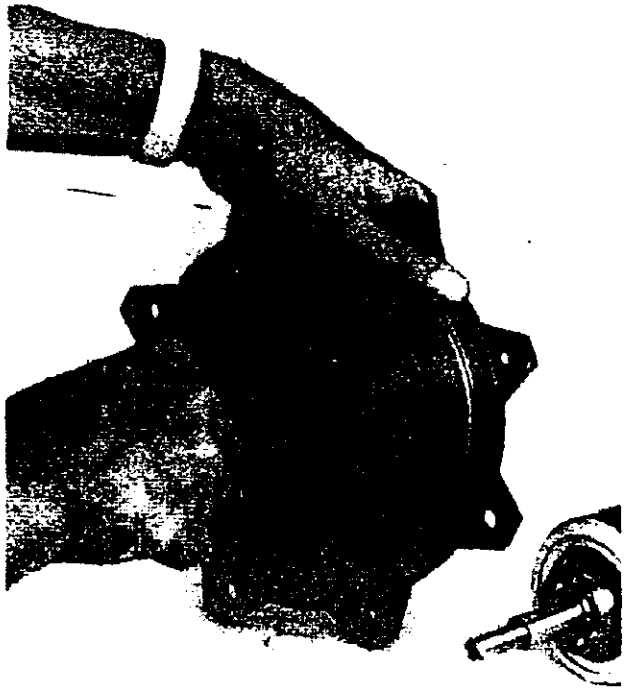


FIG. 22



FIG. 21

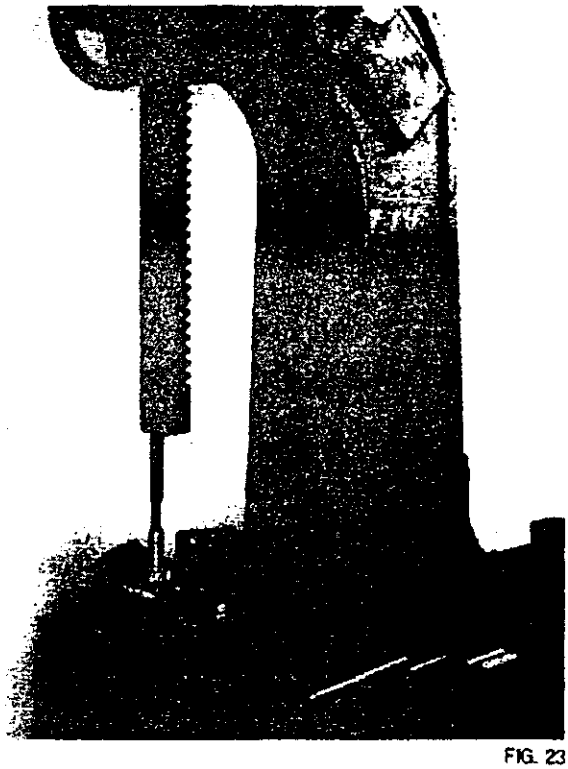


FIG. 23

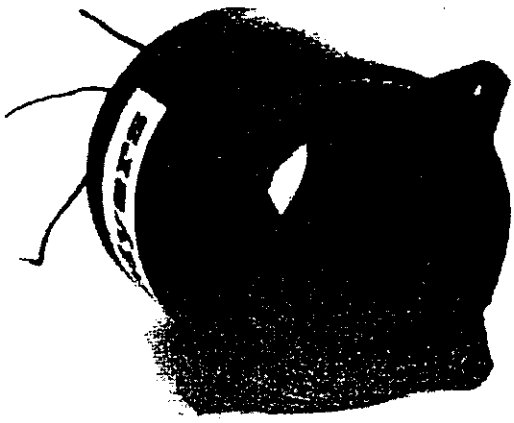


FIG. 24

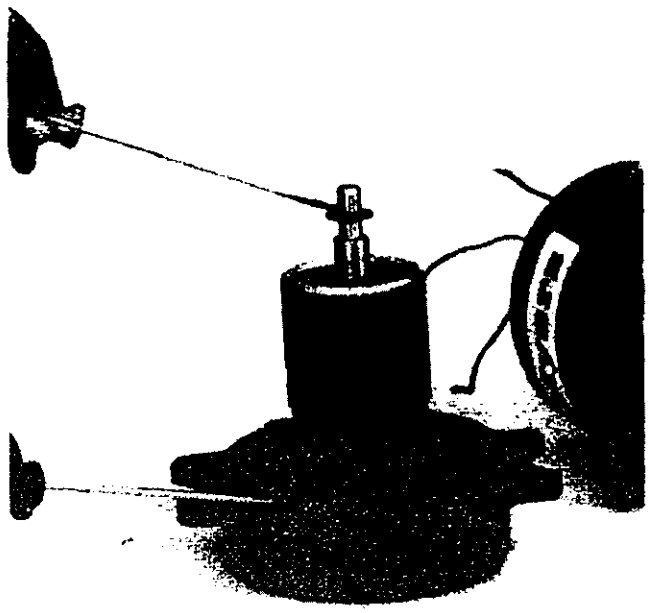
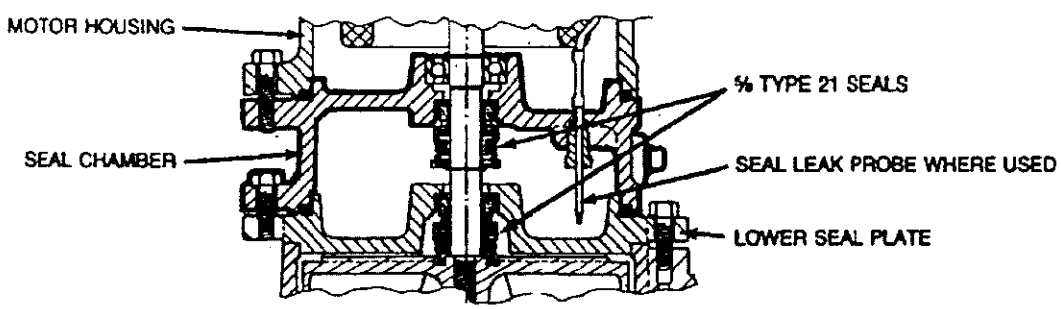


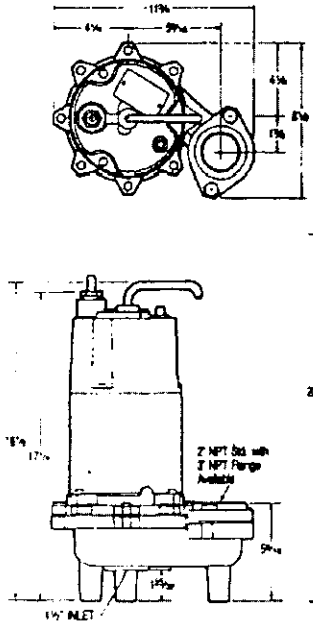
FIG. 25

SPECIAL INSTRUCTIONS FOR REPLACING SEALS IN DOUBLE SEAL PUMPS

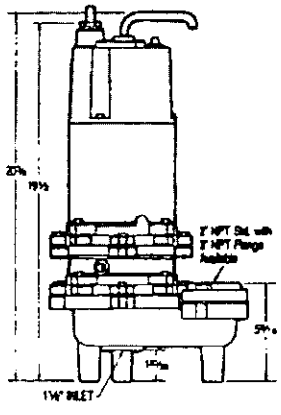
1. Remove plugs in motor housing and in seal housing and drain oil.
2. Remove bolts in lower plate only.
3. Lift off pump case.
4. Hold impeller and unscrew holding nut. Hold shaft with screwdriver and unscrew impeller, turn counterclockwise.
5. Pry off seal bellows and ceramic seat. Break seats if necessary to get out as they must be replaced with new parts.
6. NEVER USE OLD SEAL PARTS. USE ONLY COMPLETE NEW SEALS.
7. Remove snap ring with snap ring pliers.
8. Pry off upper seal bellows and ceramic seat.
9. If no water has entered motor housing (check winding with ohmmeter or megger) wipe seal chamber thoroughly and replace seals.
10. Replace oil in motor housing and seal chamber. Use only MYERS submersible oil.
11. If water has been in motor then remove seal chamber and lift out rotor unit and remove motor stator. See single seal instructions for replacing ball bearing and motor stator.



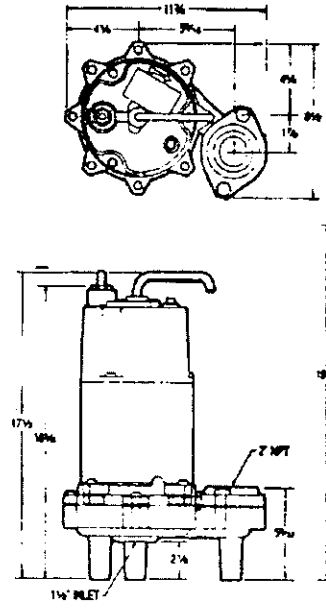
PUMP DIMENSIONS



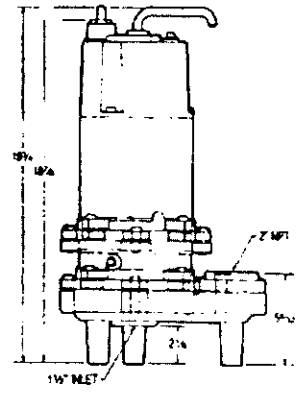
WHRH



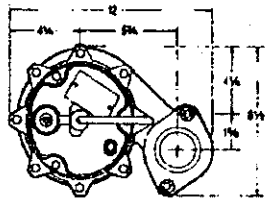
WHRH-DS

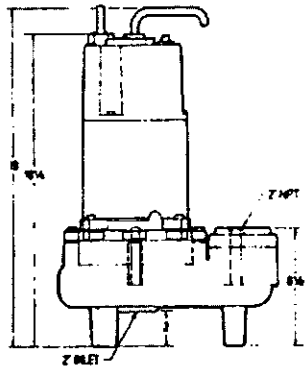


WHRE

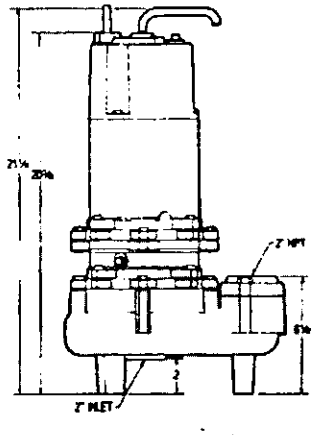


WHRE-DS





WHR



WHR-DS

MYERS
LIMITED WARRANTY
SUMP & RESIDENTIAL SEWAGE

During the time periods and subject to the conditions hereinafter set forth, **F. E. Myers** will repair or replace to the original user or consumer any portion of your new **MYERS product which proves defective due to defective materials or workmanship of MYERS.** Contact your nearest Authorized **MYERS** Dealer for warranty service. At all times **MYERS** shall have and possess the sole right and option to determine whether to repair or replace defective equipment, parts, or components. Damage due to lightning or conditions beyond the control of **MYERS** is NOT COVERED BY THIS WARRANTY.

WARRANTY PERIOD

Pumps: 12 months from date of installation or 18 months from date of manufacture, whichever occurs first.

Labor, etc. Costs: MYERS shall IN NO EVENT be responsible or liable for the cost of field labor or other charges incurred by any customer in removing and/or reaffixing any **MYERS** product, part or component thereof.

THIS WARRANTY WILL NOT APPLY: (a) to defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printed instructions provided; (b) to failures resulting from abuse, accident or negligence; (c) to normal maintenance services and the parts used in connection with such service; (d) to units which are not installed in accordance with applicable local codes, ordinances and good trade practices; or (e) unit is used for purposes other than for what it was designed and manufactured, and (f) if three phase submersible motors are installed on a single phase power supply using a phase converter or if three phase power is supplied by only two transformers, making an open Delta system.

RETURN OR REPLACED COMPONENTS: any item to be replaced under this Warranty must be returned to **MYERS** in Ashland, Ohio, or such other place as **MYERS** may designate, freight prepaid.

PRODUCT IMPROVEMENTS: MYERS reserves the right to change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such a change or improvement.

WARRANTY EXCLUSIONS: As to any specific **MYERS** product, after the expiration of the time period of the warranty applicable thereto as set forth under the heading "Warranty Periods" above, THERE WILL BE NO WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. No warranties or representations at any time made by any representative of **MYERS** shall vary or expand the provisions hereof.

LIABILITY LIMITATION: IN NO EVENT SHALL MYERS BE LIABLE OR RESPONSIBLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES RESULTING FROM OR RELATED IN ANY MANNER TO ANY MYERS PRODUCT OR PARTS THEREOF.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state. In the absence of suitable proof of this installation date, the effective date of this warranty will be based upon the date of manufacture plus one year.

Direct All Notices, etc. To: Service Department, **F. E. MYERS,** 1101 Myers Parkway, Ashland, Ohio 44805-1969.

DETERMINATION OF UNIT DATE OF MANUFACTURE: Submersible Sump pump (8-84) month and year stamped on pump nameplate; column sump pump subtract 18 months from month and year on red warranty tag.

Myers®
F.E. Myers
1101 Myers Parkway
Ashland, Ohio 44805-1969

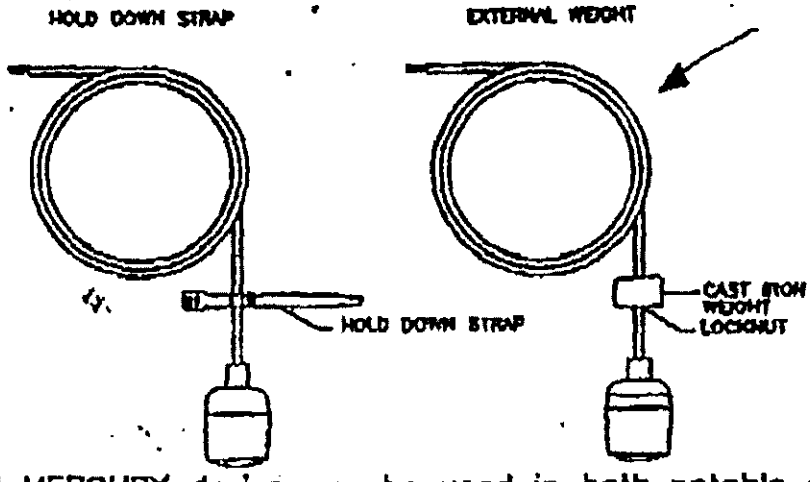
419/289-1144
FAX: 419/289-6658, TLX: 948-7443

Printed in U.S.A. 11/95

Myers
F.E. MYERS COMPANY
DIVISION OF PENTAIR CANADA, INC.
BOX 38, 259 TRILLIUM DRIVE
KITCHENER, ONTARIO N2G 3W9
TEL(519)748-5470
FAX(519)748-2583

4-Req'd
S-20-EO

NON MERCURY SENSOR SWITCH

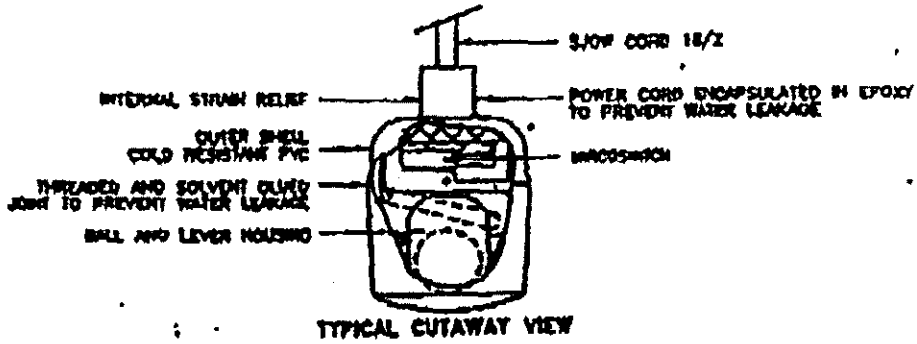


The NON MERCURY design can be used in both potable and non-potable applications.
Standard cord lengths from 10 to 35 ft.
(Consult factory for special lengths.)
Available with external weight or hold down strap.

SPECIFICATIONS

CSA certified
ELECTRICAL RATINGS: 5A 120/240V AC 60HZ
CORD RATING: 16/2 SJOW water and oil resistant
FLOAT: 2 3/4" Diameter x 4" High, c orrosion resistant PVC (grey) for use in liquids up to 140°F

S20-EO
SENSOR LENGTH IN FEET
NORMALLY OPEN(C-NORMALLY CLOSED)
EXTERNAL WEIGHT(S-STRAP)



TYPICAL CUTAWAY VIEW

Myers

F.E. MYERS COMPANY
DIVISION OF PENTAIR CANADA, INC.
[illegible] TRILLIUM DR., P.O. BOX 36, KITCHENER, ONTARIO N2G 3W9
PHONE 519/748-5670 FAX 519/748-[illegible]

CPS-115W

DUPLEX CONTROL PANEL OPERATION SEQUENCE

Duplex Control Panels are normally installed with four level controls. These level controls are installed in the basin to be pumped in the following manner:

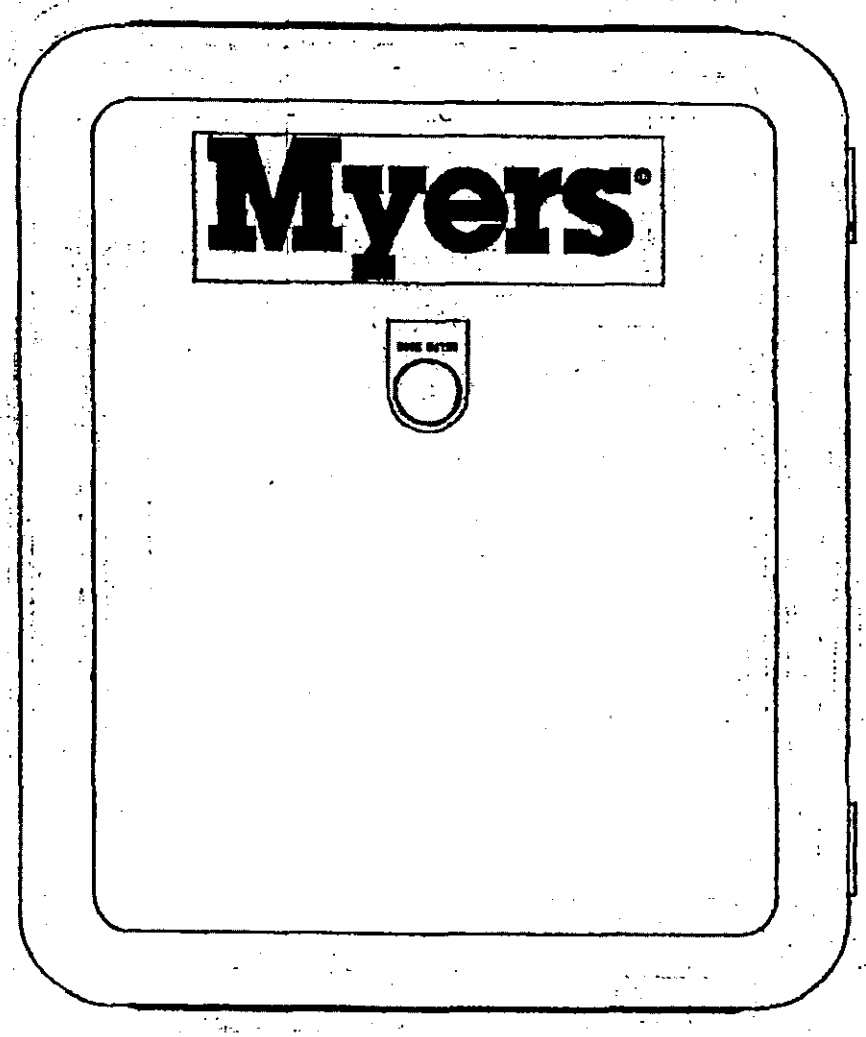
1. Lowest (first) float (OFF) when it opens stops all pump operation. It is set such that the water level at this point is at least above the top of the volute case. When this float closes it also energizes the alternator and selects the duty pump.
2. The second float (ON) from bottom energizes the contactor of the duty pump. It is set at a height above the "off" float, whenever possible, to give the pump at least two minutes run time.
3. The third float (OVERRIDE) is set just above the second. When it closes it energizes the contactor of the non duty pump. This condition exists when inflow is greater than pump capacity, or the duty pump has failed to perform.
4. The fourth float (HIGH WATER ALARM) is usually set above the override float and closes the alarm circuit. This float can be set between the override and start floats to alarm the fact that the first pump has not been able to perform its function. It is possible to combine the override and high water alarm functions in one float. (Option "P").

Myers®

INSTALLATION AND
SERVICE INSTRUCTIONS
FOR 1Ø AND 3Ø DUPLEX

Myers CE Control Panels

CE-11D, CE-11DW (¼-½ HP, 115V, 1PH)
CE(DS)-11D, CE(DS)-11DW (½ HP, 115V, 1PH)
CE-21D, CE-21DW (½-2 HP, 230V, 1PH)
CE(DS)-21D, CE(DS)-21DW (½-2 HP, 230V, 1PH)
CE-23D, CE-23DW (½-2 HP, 208-230V, 3PH)
CE-43D, CE-43DW (½-2 HP, 460V, 3PH)



23833A149

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LOCATION AND MOUNTING

NEMA 1 ENCLOSURES: (INDOOR USE)

Locate the control box in a convenient location, preferably close to the pump installation. The box may be secured to a wall or other stable vertical support by use of the four mounting holes located on the back side of the control panel.

The box should be mounted approximately 5 feet from the floor to the circuit breaker handle. Care should be taken to avoid mounting the control box under sweating pipes, faucets or other damp locations.

NEMA 4X ENCLOSURES: (OUTDOOR USE)

The control box may be mounted at the location of the pump and basin or may be mounted in a remote location. The box should be secured to a stable vertical support which in turn should be secured to a concrete basin or footer. The box could also be mounted to the side of the house or other stationary support if available within a reasonable distance. When selecting a location, you should consider the visibility of the alarm light.

The box may be secured by the use of four mounting holes located in the mounting feet on the top and bottom of the box. The box should be mounted approximately 5 feet from the ground to the circuit breaker handle.

POWER SUPPLY

WARNING:
Do not attempt to wire this control box unless you have a good working knowledge of electricity and are familiar with state and local codes. If you are in doubt about anything, contact an electrician.

The power supply for the control box will vary depending upon which particular model you have purchased. **Do not** attempt to operate this unit on any other voltage or power distribution other than what it was originally designed. **Failure to comply with this will result in the immediate cancellation of all warranties and claims.**

It is advisable to put the pump on its own circuit using a circuit breaker adequately sized to protect the pump. Check state and local codes for the correct wire size and circuit protection to use. The wire should be sized large enough to handle the full load current of both pumps you are operating, and any voltage drop that might occur due to long service runs.

Run power supply lines to the control box and secure (knockouts are not supplied in this box). Select a convenient location on the bottom for NEMA 4X enclosures, or on the top, sides or bottom for NEMA 1 enclosures, to enter the box with the power supply. Cut a hole with a chassis punch, caution should be taken not to get metal or fiberglass chips in the components while cutting hole. After the hole is cut, any metal or fiberglass particles **must** be removed from box. Failure to do so may result in premature component failure.

Connect incoming power to the circuit breaker top lugs and all necessary ground wires to the ground lug at the bottom of the box. The ground lug should be fastened to a good driven earth ground by one of the methods described in the National Electric Code.

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CONNECTING PUMPS AND FLOATS TO CONTROL BOX

PUMP CORDS:
Run the wires from both pumps to the bottom of the control box by means of one of the methods described in your pump or basin installation instructions. A hole must be cut into the control box (use the same procedure as that described for incoming power supply lines).

Connect black wires to terminals marked M1, M2 and M3 (for 3 phase applications), or connect the black and white wire to terminals marked M1 and M2 (for 1 phase applications). Fasten green wire to ground lug.

Some WHRE & WHRH pumps may have an additional red or orange wire in the pump cord. This is for the seal leak probe and it should be connected to the terminal strip in the control box. See wiring diagram for the proper terminal connections.

NOTE: On 3 phase installations check for proper pump rotation. See the "ROTATION OF 3 PHASE PUMPS" section in this manual.

FLOAT CORDS:
See basin instructions for the proper depth at which to set the floats. Strip the float cord wires ⅜", twist strands together, and connect black and white wires to terminal strip in the control box. See wiring diagram for proper terminal connections.

OPERATING PUMPS

1. Make sure that all wires are inside the control box and not in a position to be pinched or shorted when the door is closed.
2. Turn on power to the control box.
3. Turn hand-off-auto switches to the "HAND" position. The pumps should start and the pump run lights should come on.
4. The alarm should activate when the alarm test switch is used.
5. To put into service, put the hand-off-auto switches in the "AUTO" position. See basin instructions.
6. If unit does not operate as described, see troubleshooting chart.

NOTE: Addition of electrical components and circuitry to this unit is expressly forbidden unless written factory authorization is obtained. Failure to do so will result in warranty cancellation.

ROTATION OF THREE PHASE PUMPS

IMPORTANT:
Rotation of three phase pumps must be established by one of the two methods described below.

CAUTION:
Keep hands and feet clear of impeller when checking rotation. Be sure to disconnect power to the control box while handling pumps. Make sure pump is wired and readied for rotation test before the control box is energized.

1. Before positioning pump in basin, run wires to control box. Lay the pump unit on its side and secure so that the starting torque of the motor will not cause the pump to roll. Energize the pump by turning the circuit breaker on and the hand-off-auto to "HAND". The rotation should be counterclockwise as observed facing the bottom of the pump.

   If you do not get the proper rotation, disconnect the power to the control box and change the position of any two of the black motor leads in the terminal blocks.
2. Install the pump in the basin and run in some water so the pump can operate. Energize the pump by turning the circuit breaker on and the hand-off-auto switch to "HAND". Let the pump pull the water down in the basin, and when the water reaches the bottom of the pump the rotation of the water can be observed. The water should rotate in a clockwise direction if the pump rotation is correct.

   If you do not get the proper rotation, disconnect the power to the control box and change the position of any two of the black motor leads in the terminal blocks.

Myers®

CHECKING PUMP CURRENT DRAW

1 PHASE PUMPS:

1. Use a amprobe to check the amperage of either the black or white wire going to the pump.
2. Turn the hand-off-auto switch to the "HAND" position and compare the amperage reading to the values shown on the chart. (See page 7).
3. If you get a reading of 0, make sure there is voltage to the motor leads. The on-winding overload may be tripped. Wait 15 minutes and try again. If you still do not get a reading, either the motor has failed or there might be a wiring problem between the control panel and pump (improper connection in the junction box).

3 PHASE PUMPS:

1. Use an amprobe to check the amperage of any of the black wires going to the pump.
2. Turn the hand-off-auto switch to the "HAND" position and compare the amperage reading to the values shown on the chart.
3. If you get a reading of 0, make sure there is voltage to the motor leads. Push the overload reset button on the overload relay in the control panel. If you still do not get a reading, either the motor had failed or there might be a wiring problem between the control panel and pump (improper connection in the junction box).
4. If you get high amperage readings on 2 black wires and a zero reading on the third, you have a single phase condition which could be caused by one of the following:

   A. One motor lead is not connected properly.

   B. You have lost 1 phase of the 3 phase power coming into the panel.

   C. One winding in the motor is open.

CHECKING PUMP AND FLOAT RESISTANCE

TO CHECK PUMP OR FLOAT, DISCONNECT INCOMING POWER AND REMOVE WIRES FROM THE TERMINAL BLOCK AND WITH AN OHMMETER CHECK THE MEASUREMENTS PER CHART.

CORD MEASURED	ITEM MEASURED	CORRECT READING	OHMMETER SETTING	IF YOU GET ANY OTHER READING CHECK FOR THE FOLLOWING:
Power Cord	Motor Winding (3 Phase) (Any Black to Black)	(See Chart)	R × 1	Damaged winding or cord or tripped heat sensor
Power Cord	Motor Winding (1 Phase) (White to Black)	(See Chart)	R × 1	Damaged winding or cord or tripped heat sensor
Power Cord	Ground to Motor Windings (Green to Black or White)	Infinity to 200	R × 100K	Damaged winding or cord moisture in motor
Float Cord	Ground to Float Contacts (Green to Black or White)	Infinity to 200	R × 100K	Water in float or damaged cord
Float Cord	Float Contacts (Black to White)	0 - Float on Infinity-Float off	R × 1	Switch has failed or damaged cord

NOTE: Readings may vary slightly depending on length of wire running to the motor and the accuracy of the measuring instrument.

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TESTING COMPONENTS IN CONTROL BOX

WARNING:
To prevent electrical shock, disconnect power entering the control box and turn the circuit breaker in the control box to the "OFF" position.

CONTACTOR:
1. Physically examine the contactor for badly burnt or sticking contacts. The contactor arm should move in and out freely.
2. Remove the wires on the coil to the contactor and measure the resistance. Zero the ohmmeter, and on the R × 1 scale you should read approximately 138 ohms.
3. Often a burnt coil can be spotted by merely looking to see if it is badly discolored or has a dark burnt spot on it.

TRANSFORMER: (3 PHASE PANELS ONLY)
208 VOLT
1. Remove the wires from the primary side (H3-H4) and also from the secondary side (X2-XF-X1).
2. With an ohmmeter on the R × 1 scale touch terminals H3 and H4 (primary), you should get a reading of approximately 5.8 ohms.
3. With an ohmmeter on the R × 1 scale touch terminals X2 and X1 (secondary), you should get a reading of approximately 1.6 ohms.
4. With an ohmmeter on the R × 1 scale touch terminals XF and X1, you should get a reading of 0. If you do not, replace the fuse.

230 VOLT
1. Remove the wires from the primary side (H2-H4) and also from the secondary side (X2-XF-X1).
2. With an ohmmeter on the R × 1 scale touch terminals H2 and H4 (primary), you should get a reading of approximately 6.5 ohms.
3. With an ohmmeter on the R × 1 scale touch terminals X2 and X1 (secondary), you should get a reading of approximately 1.6 ohms.
4. With an ohmmeter on the R × 1 scale touch terminals XF and X1, you should get a reading of 0. If you do not, replace the fuse.

460 VOLT
1. Remove the wires from the primary side (H1-H4) and also from the secondary side (X2-XF-X1).
2. With an ohmmeter on the R × 1 scale touch terminals H1 and H4 (primary), you should get a reading of approximately 21.5 ohms.
3. With an ohmmeter on the R × 1 scale touch terminals X2 and X1 (secondary), you should get a reading of approximately 1.6 ohms.
4. With an ohmmeter on the R × 1 scale touch terminals XF and X1, you should get a reading of 0. If you do not, replace the fuse.

OVERLOAD BLOCK: (3 PHASE PANELS ONLY)
1. Remove the wires from the terminals on the side of the overload block.
2. With an ohmmeter on the R × 1 scale touch the two terminals, you should get a reading of 0. If you do not get this reading, push the large black reset button on the front of the overload block.
3. You may test the inner switching mechanism by pushing the small black button on the front of the overload block to trip the switch and pushing the large black button to reset it. If the inner switch does not work properly replace the overload block.

OVERLOAD HEATERS: (3 PHASE PANELS ONLY)
1. Remove the heaters from the overload block and examine them for physical damage. A slight discoloration is normal, but if they are melted or warped they should be replaced.

FUSES:
1. Pull the fuse out of the fuse block and check for continuity with an ohmmeter.
2. With the ohmmeter on the R × 1 scale, you should get a reading of 0. If you do not, replace it with the same type and rating that is shown on the decal located next to the fuse block.

ALARM BUZZER: (NEMA 1 ENCLOSURES)
1. The buzzer should activate when the alarm test switch is used, if not:

   With the ohmmeter on the R × 100 scale touch the WH/RED wire on the alarm test switch, and the white wire on the pump run light. You should get a reading of approximately 12.0 (1200 ohms). If you do not replace the buzzer.

ALARM LIGHT: (NEMA 4X ENCLOSURES)
1. The light should activate when the alarm test switch is used, if not replace the light bulb.

OVERRIDE RELAY:
1. Physically examine the relay for burnt or stuck contacts and for a burnt or discolored coil.
2. Remove the relay from the socket and with an ohmmeter or R × 1000 scale, you should read approximately 7.68 ohms on pins 13 and 14.

ALTERNATOR RELAY:
1. When power is on and the relay is functioning properly, one of the two lights on top of the relay should be on.
2. With circuit breaker turned "off," remove relay from socket. With an ohmmeter on the R × 1000 scale, touch the alternator coil terminals. The "black" lead should be on pin 3, and the "red" lead should be on pin 5. You should have a reading of approximately 920-1020 ohms.
3. If alternator shows physical damage or does not test properly, replace it.

TROUBLESHOOTING CHART

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Problem	Position of Hand-Auto Switch	Run Light	Check
Pump 1 AND 2 Will Not Run	Hand	On	G-A-L-K
	Hand	Off	C-E-B-G
	Auto	On	A-G-L-K
	Auto	Off	F-I-C-B-E-G
Pump 1 OR 2 Will Not Run	Hand	On	A-G-K
	Hand	Off	C-G-L
	Auto	On	A-G-K-L
	Auto	Off	M-F-G
Alarm Activates	Auto	Both Lights On	H-I-J
	Auto	Only One Light On	G-D
	Auto	No Run Light On	E-L
Circuit Breaker Tripped	Auto-Off-Hand	Off	G-N
Fuse in Control Circuit Blown	Auto-Off-Hand	Off	H-I-J
Control Box Buzzes	Auto-Off-Hand	On Or Off	L

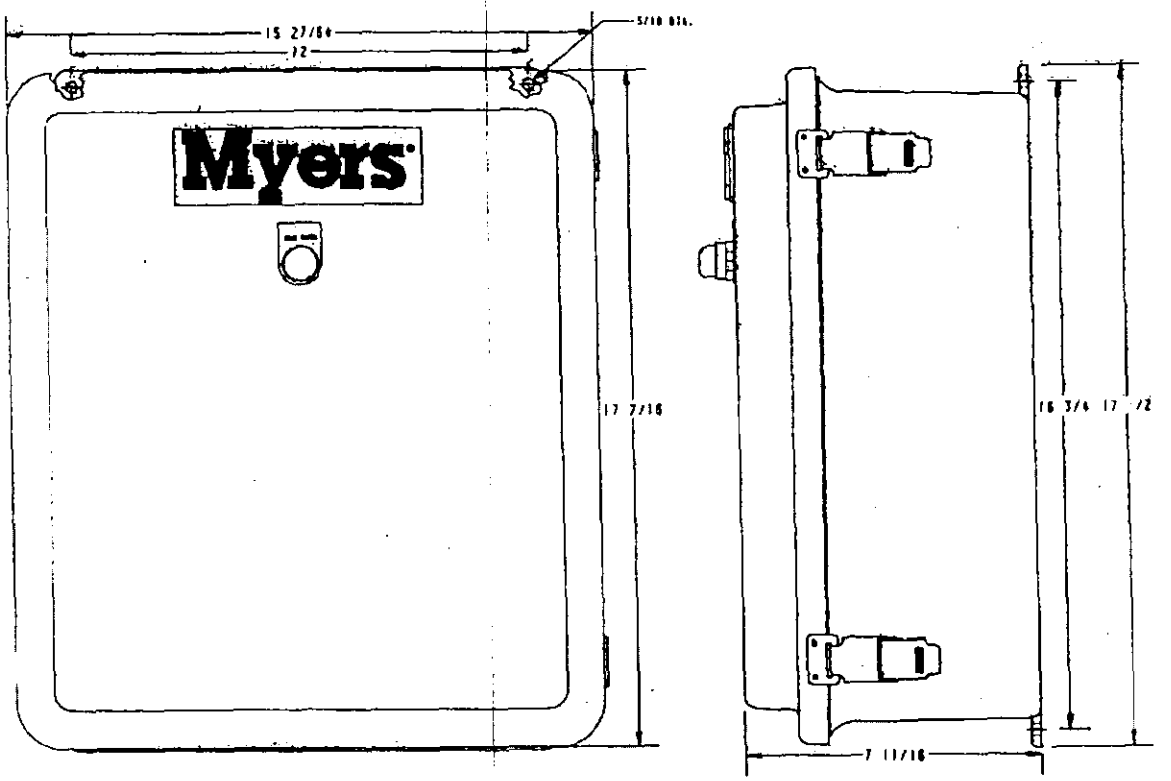
CAUSE	REMEDY
A Motor overload tripped.	(1 PHASE ONLY). Wait 5 min. The thermal overload will reset automatically. (If pump is out of water or in warm water, it will take longer for the overload to reset). If the overload trips again, service pump.
	(3 PHASE ONLY). Reset by pushing overload reset button. If overload does not trip again problem may be fixed. If overload trips again, check power supply voltage. Check motor winding resistance, make sure pump shaft is not locked.
B Tripped circuit breaker or fuse at power supply panel —wrong supply voltage.	Reset breakers or replace fuses. If they continue to blow, check amp capacity of wire and breakers. Make sure it is wired properly and that you have the correct power supply system. (See Instructions "Power Supply").
C Tripped circuit breaker in control panel.	Reset by pushing handle down to "OFF" position and resetting to "ON" position. Make sure that wires are not shorted and that the box is wired properly.
D Override relay not working properly.	Try operating both pumps in "HAND" position. If the run lights come on and pumps operate properly. Replace override relay.
E Control circuit fuse blown.	Check fuse per instructions. Replace fuse with same type and rating.
F Level in basin may not be high enough to turn switch on.	Check basin. Run pump manually to see if pump operates properly.
G May not be wired properly.	Check wiring per wiring diagram. Make sure pump is connected to terminal block properly.
H Too much water coming into basin.	Reduce water flow. Pump may need servicing.
I Float switch may have failed.	Operate manually to see if basin pumps down and alarm goes off. Repair float if necessary.
J Pump or discharge line may be plugged.	Pull pump and check discharge line and pump inlet. (CAUTION: Never put hands on grinder impeller unless power is turned off).
K May be failed component operating coil.	Check components per instructions.
L Wrong operating voltage or wrong voltage components.	Check voltage and make sure relays and contactors are of the proper voltage.
M May not be lead pump in alternating phase—alternator may not be working properly.	Let float switches cycle basin to see if alternator is alternating pumps. If not, check alternator relay per instructions.
N May be short circuit in wiring or pump power supply—Short in motor.	Check wiring. (Short will not be located in control circuit unless control circuit fuse is blown). Check motor. (See chart for checking pump cable).

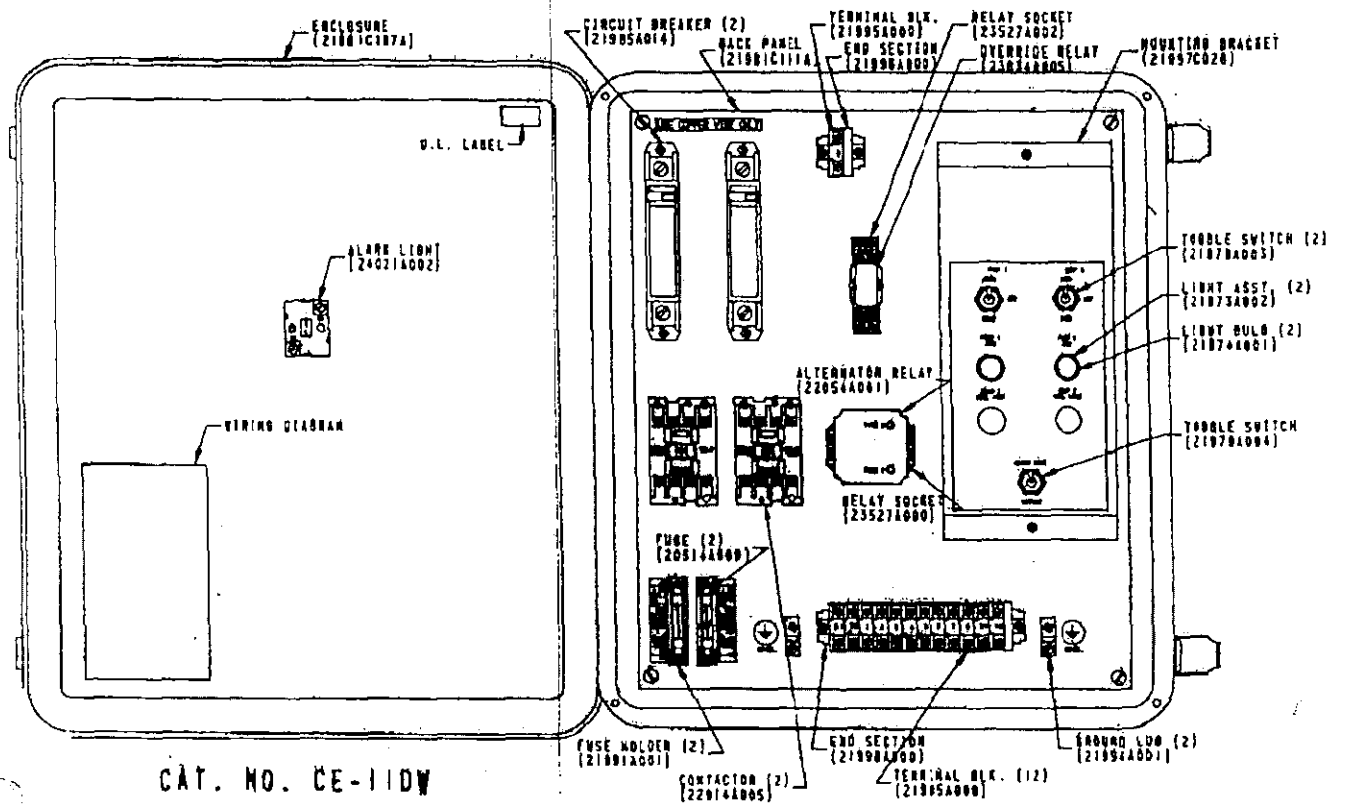
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PUMP CURRENT DRAW, WINDING RESISTANCE, OVERLOAD HEATER SELECTION*

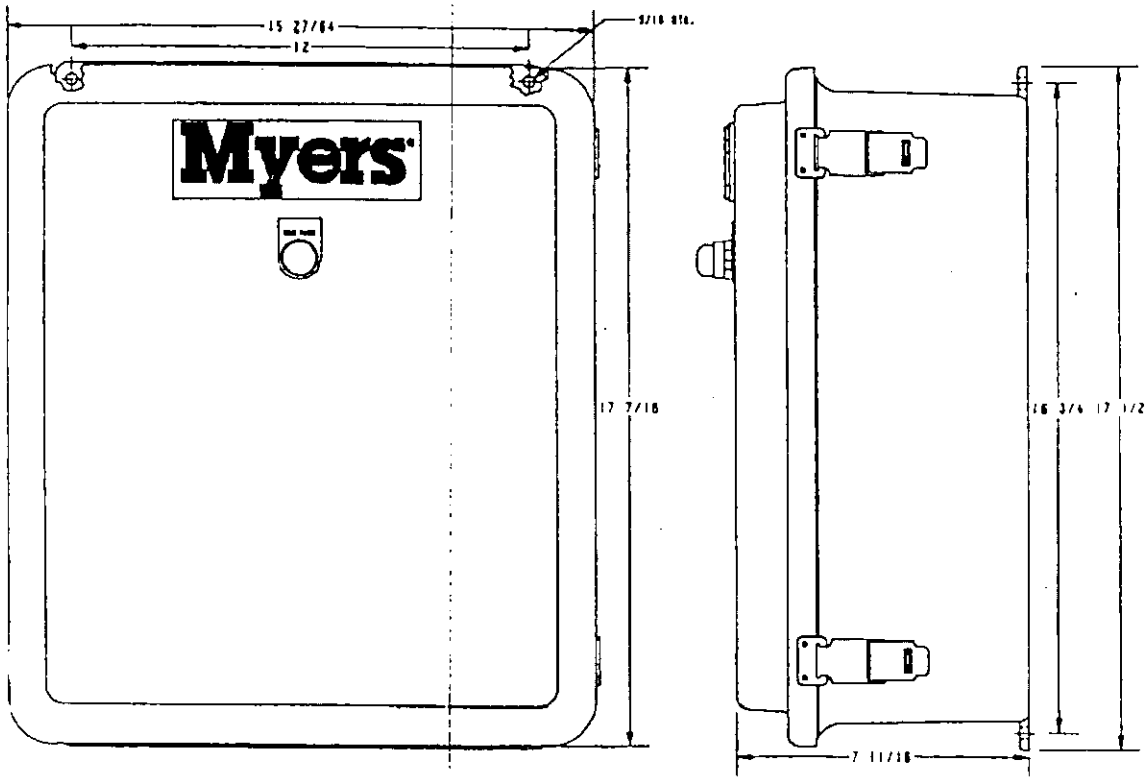
MODEL	HP	VOLTAGE	PHASE	RPM	F.L.A.	L.R.A.	RESISTANCE	HEATER	HEATER NO.
SS25	1/4	115	1	1750	8.0	12.0	2.30	—	—
SS4-11	4/10	115	1	1750	12.0	18.0	1.20	—	—
SS4-21	4/10	230	1	1750	6.0	9.8	4.30	—	—
SR4-11	4/10	115	1	1750	12.0	16.0	1.20	—	—
SR4-21	4/10	230	1	1750	6.0	8.2	4.30	—	—
WHR5-11	1/2	115	1	1750	12.0	20.2	1.33-1.47	—	—
WHR5-21	1/2	230	1	1750	6.0	9.1	5.04-5.60	—	—
WHR5-03	1/2	208	3	1750	3.6	8.0	10.9-12.1	K32	13621A098
WHR5-23	1/2	230	3	1750	3.2	7.5	13.5-14.9	K31	13621A080
WHR5-43	1/2	460	3	1750	1.6	3.8	54.0-59.6	K21	13621A109
WHR7-21	3/4	230	1	1750	7.5	12.5	3.96-4.40	—	—
WHR7-03	3/4	208	3	1750	5.3	16.5	4.87-5.37	K37	13621A088
WHR7-23	3/4	230	3	1750	4.2	10.8	9.17-10.2	K34	13621A104
WHR7-43	3/4	460	3	1750	2.1	5.4	36.7-40.6	K26	13621A086
WHR10-21	1	230	1	1750	11.0	20.5	2.60-2.88	—	—
WHR10-03	1	208	3	1750	6.2	20.5	3.32-3.66	K41	13621A081
WHR10-23	1	230	3	1750	5.2	17.5	4.87-5.40	K37	13621A088
WHR10-43	1	460	3	1750	2.8	8.7	19.5-21.6	K29	13621A087
WHRE&H5-11	1/2	115	1	3450	14.4	27.5	.83-.94	—	—
WHRE&H5-21	1/2	230	1	3450	7.2	14.2	4.40-4.86	—	—
WHRE&H5-03	1/2	208	3	3450	5.9	12.5	5.40-6.10	K39	13621A093
WHRE&H5-23	1/2	230	3	3450	4.8	11.8	7.00-8.00	K36	13621A082
WHRE&H5-43	1/2	460	3	3450	2.4	6.0	28.0-32.0	K26	13621A086
WHRE&H10-21	1	230	1	3450	9.0	18.5	2.84-3.14	—	—
WHRE&H10-03	1	208	3	3450	6.5	22.5	3.15-3.65	K41	13621A081
WHRE&H10-23	1	230	3	3450	5.5	20.3	4.85-5.42	K39	13621A093
WHRE&H10-43	1	460	3	3450	2.75	10.5	19.4-21.7	K29	13621A087
WHRE&H20-21	2	230	1	3450	14.5	25.4	1.60-1.80	—	—
WHRE&H20-03	2	208	3	3450	10.5	34.0	2.65-2.93	K52	13621A097
WHRE&H20-23	2	230	3	3450	8.5	32.5	3.12-3.45	K49	13621A062
WHRE&H20-43	2	460	3	3450	4.9	16.3	12.5-13.8	K36	13621A082
E3-11	1/3	115	1	3450	14.0	25.0	.90-1.1	—	—
E3-21	1/3	230	1	3450	7.0	13.0	3.4-3.6	—	—
E10-21	1	230	1	1750	10.7	32.0	2.5-3.0	—	—

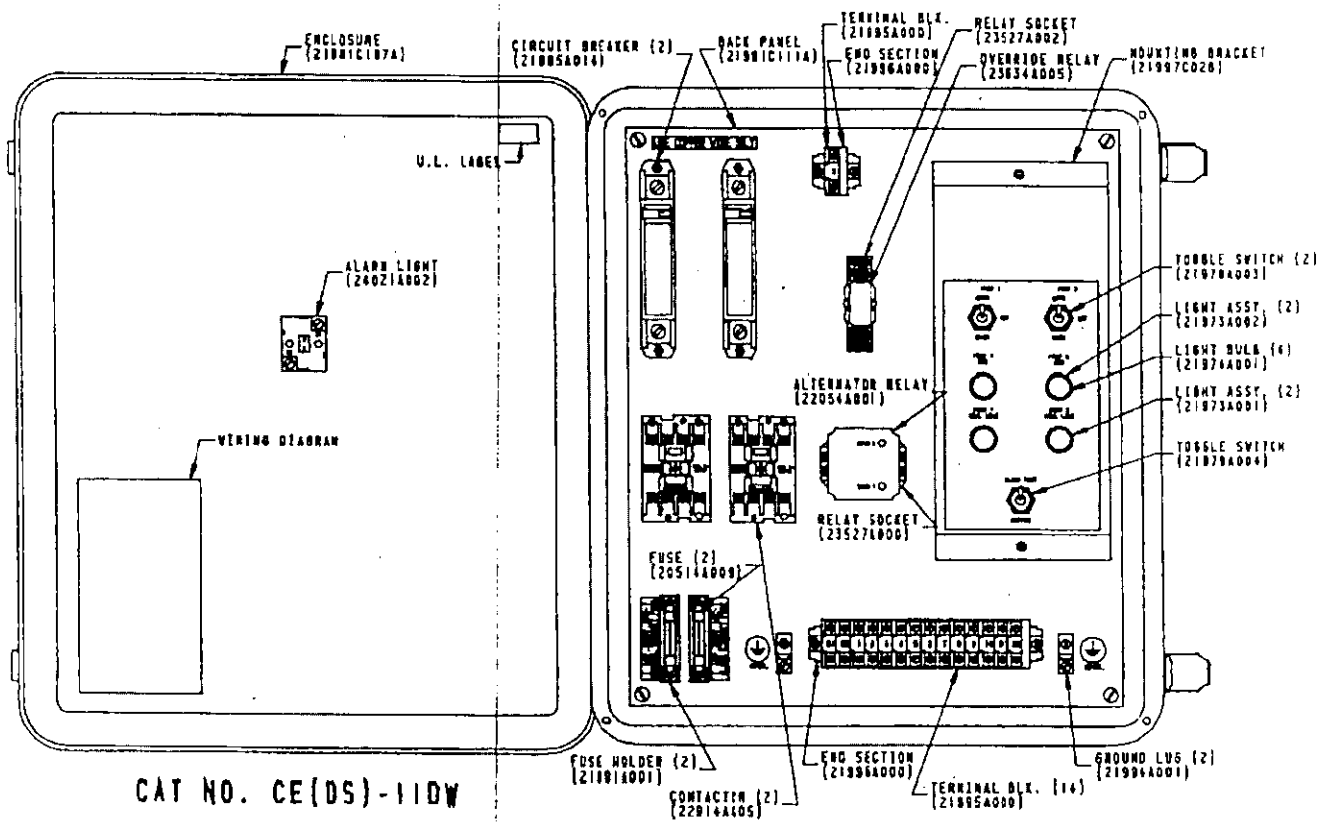
***WARNING:** On 3 phase panels, overload heater elements are not factory installed in the overload relay. Elements must be purchased separately and correspond with the above chart. This must be done **before** the panel is put into service. Failure to install the elements before the panel is put into service, or failure to install the correct size elements, may result in pump failure. All pump and panel warranties will be voided if the above guidelines are not followed.



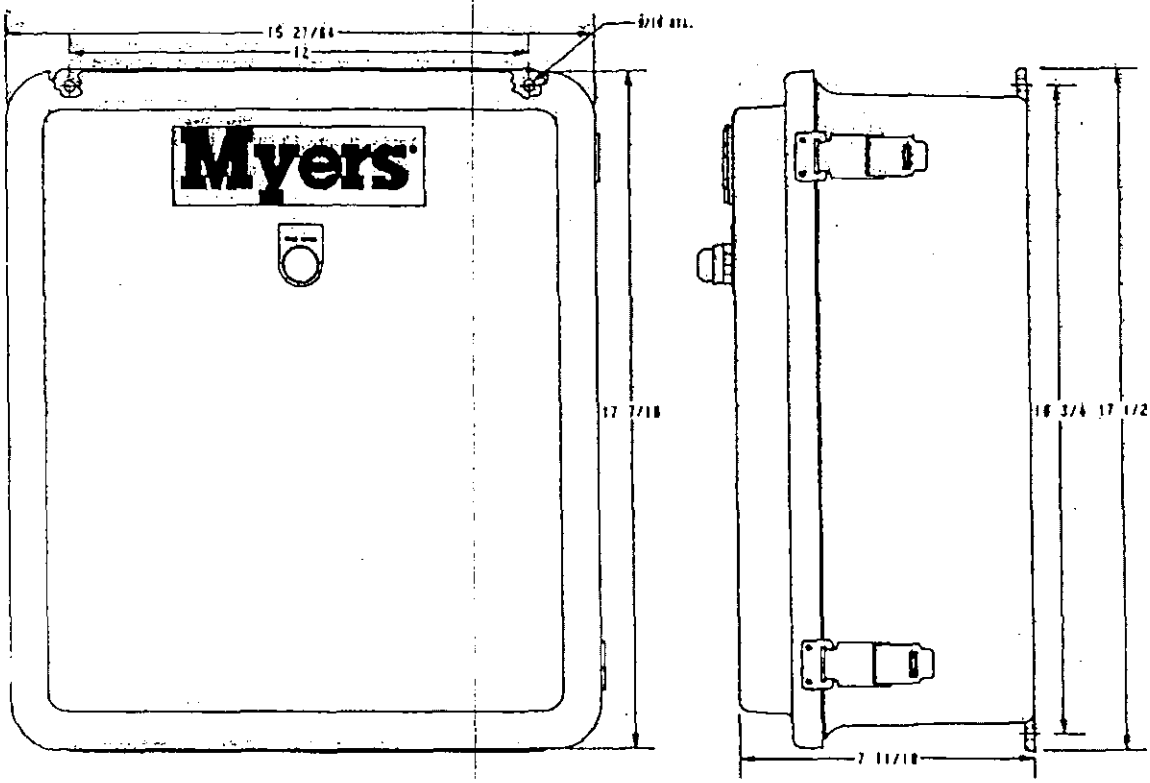


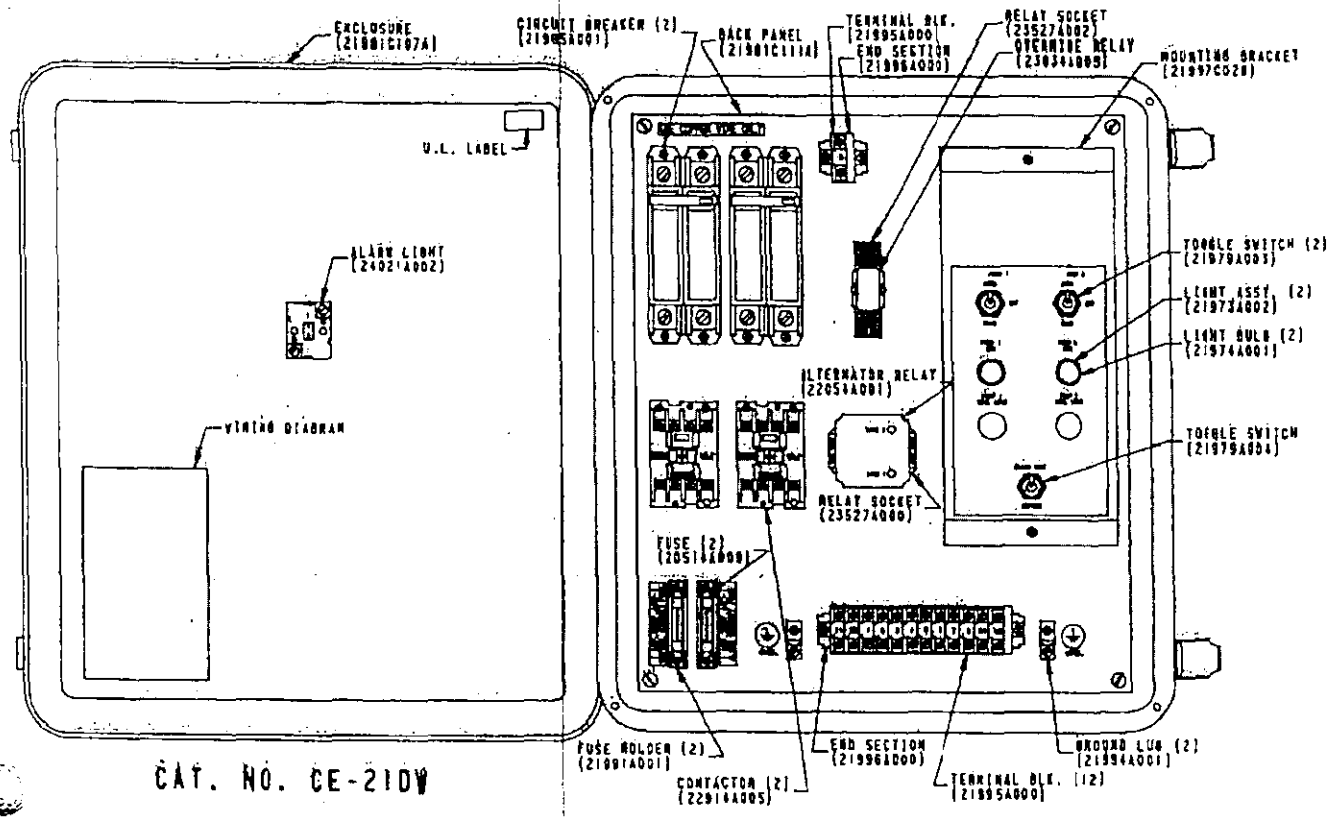
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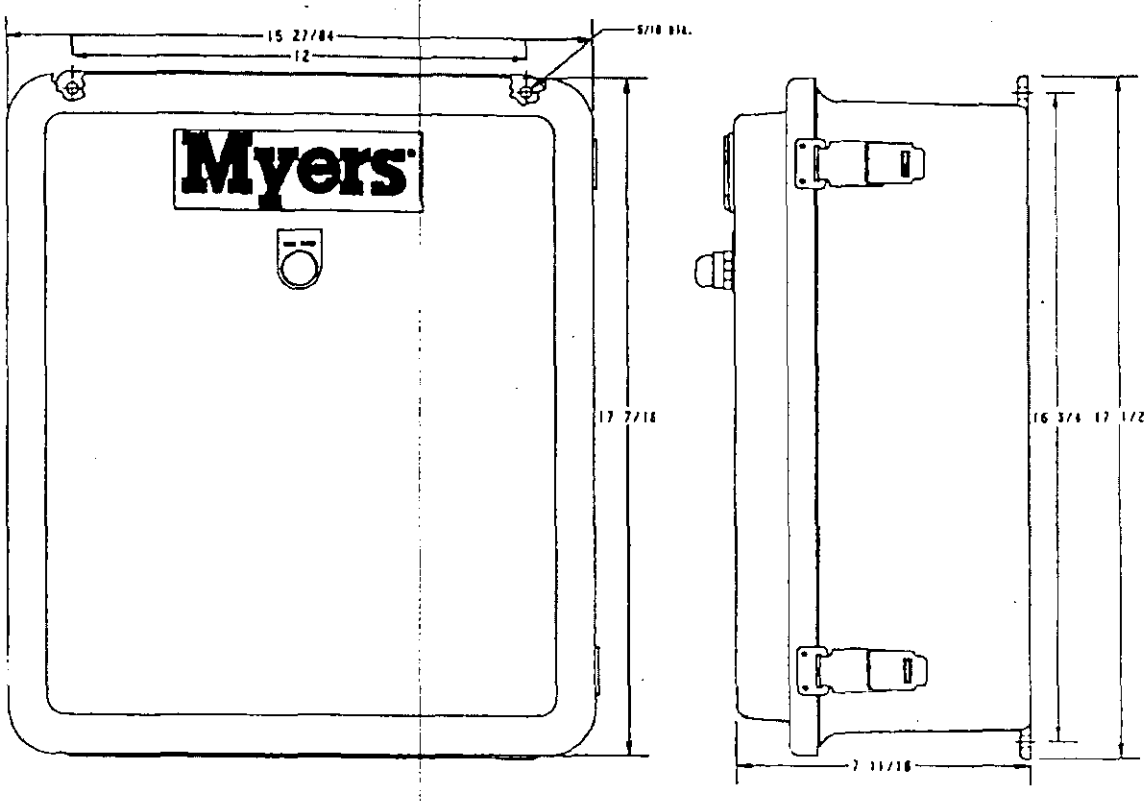


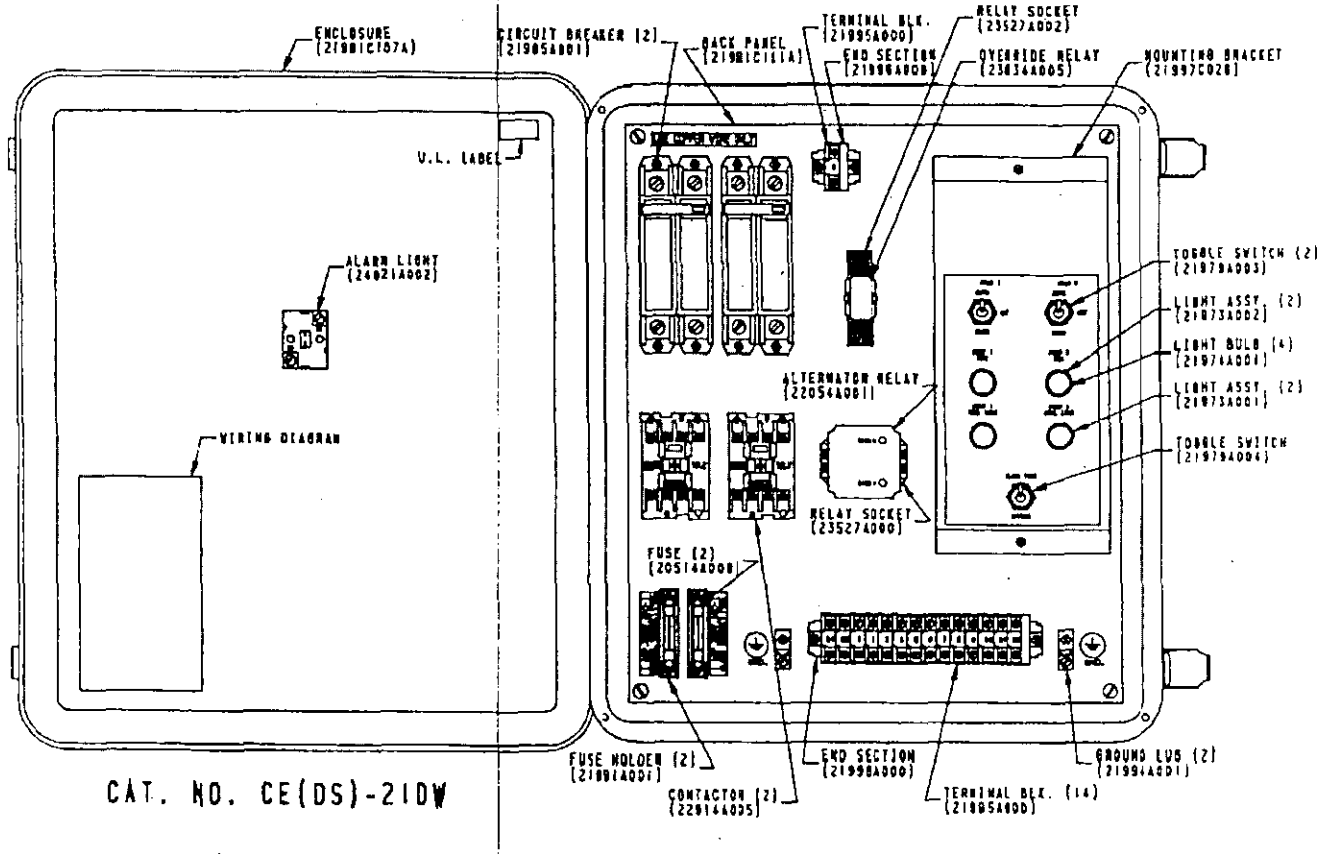
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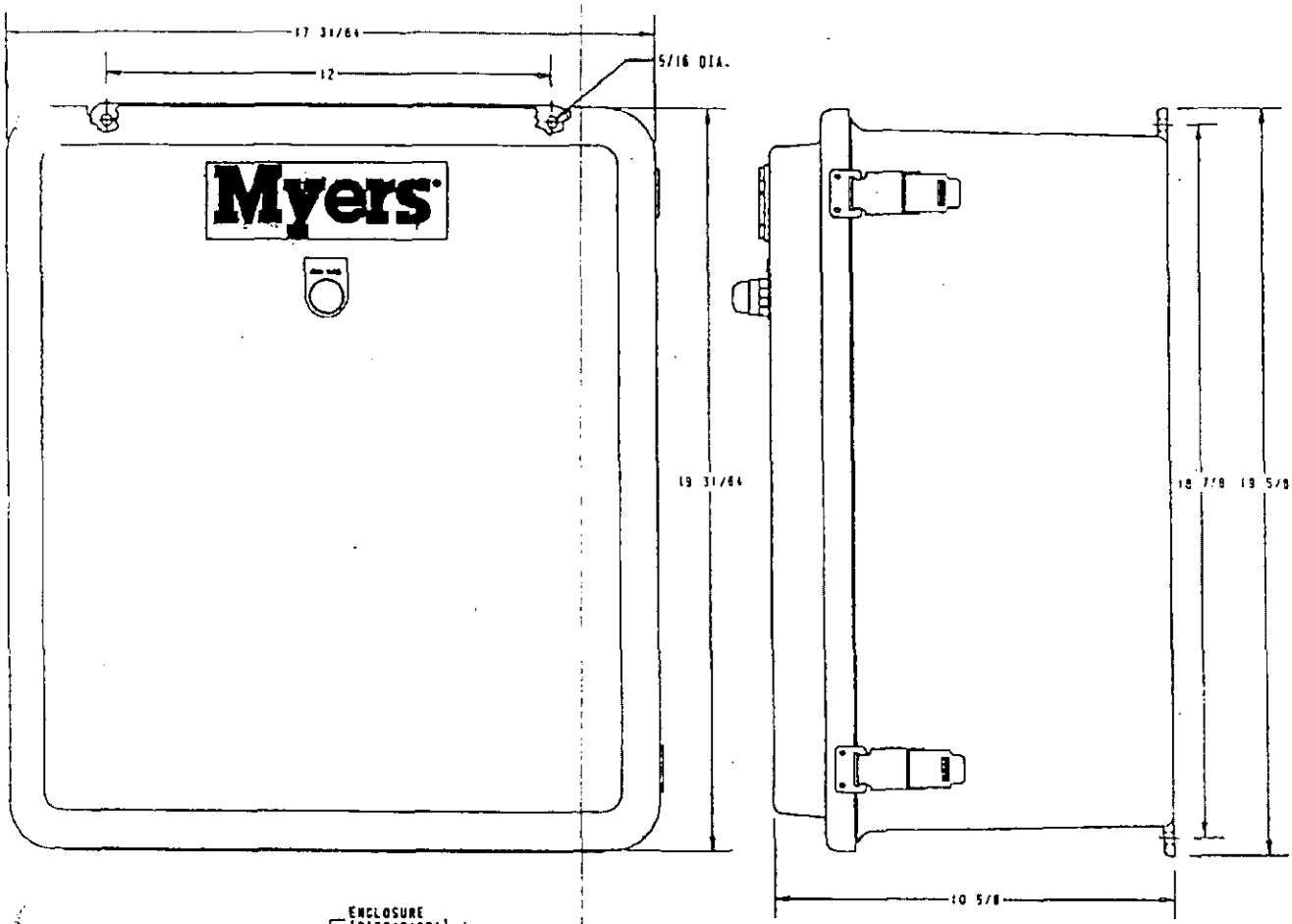


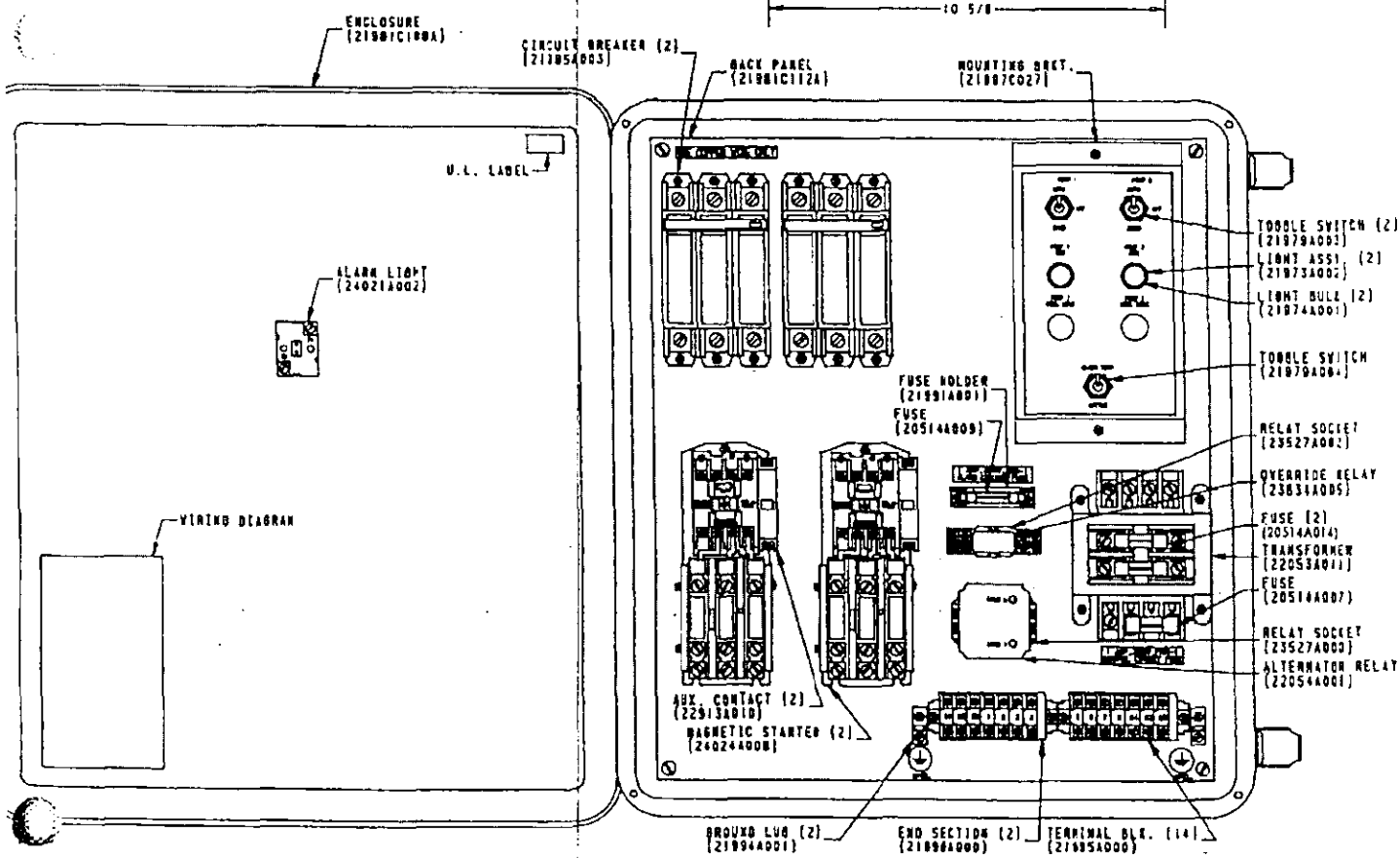
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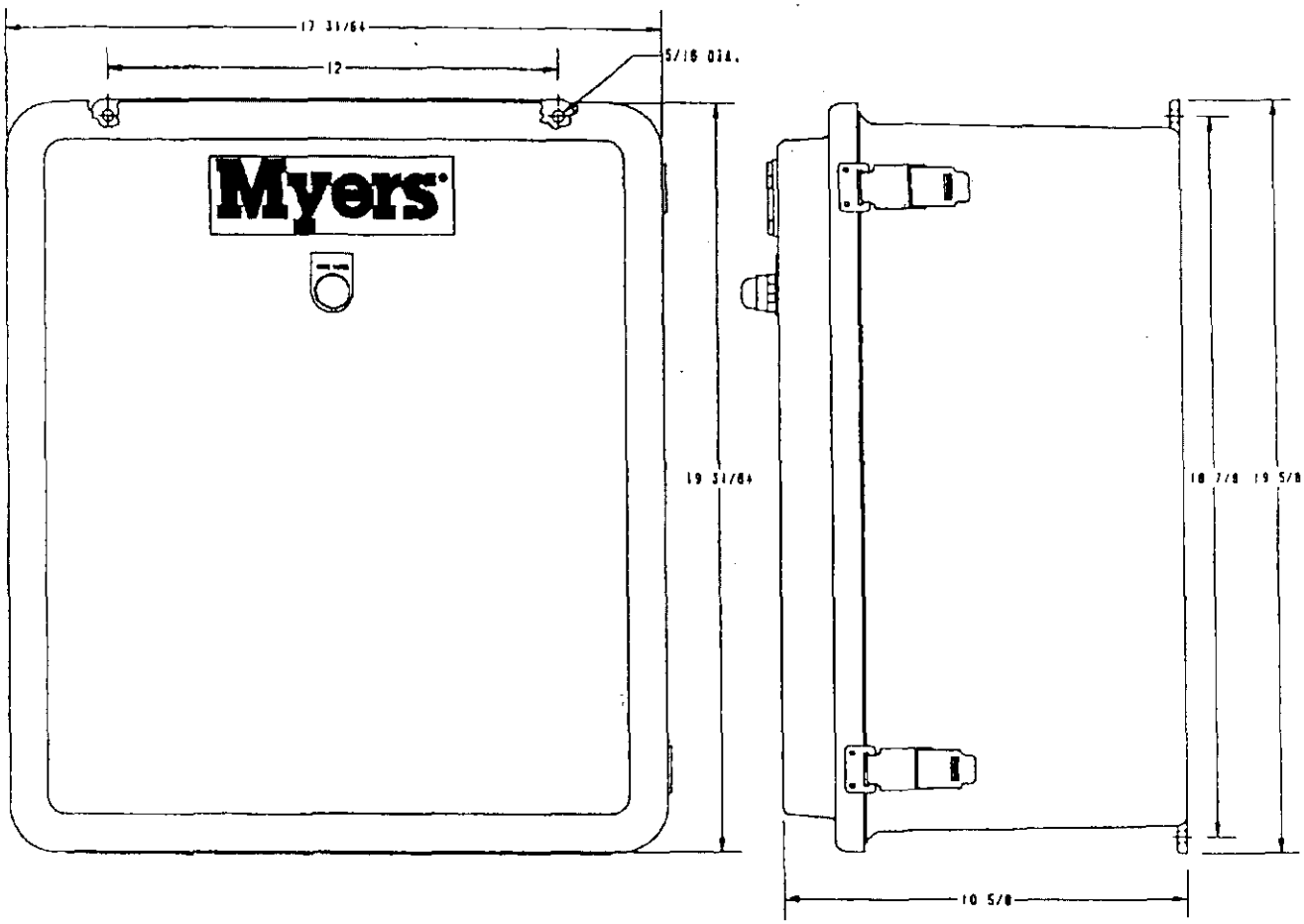
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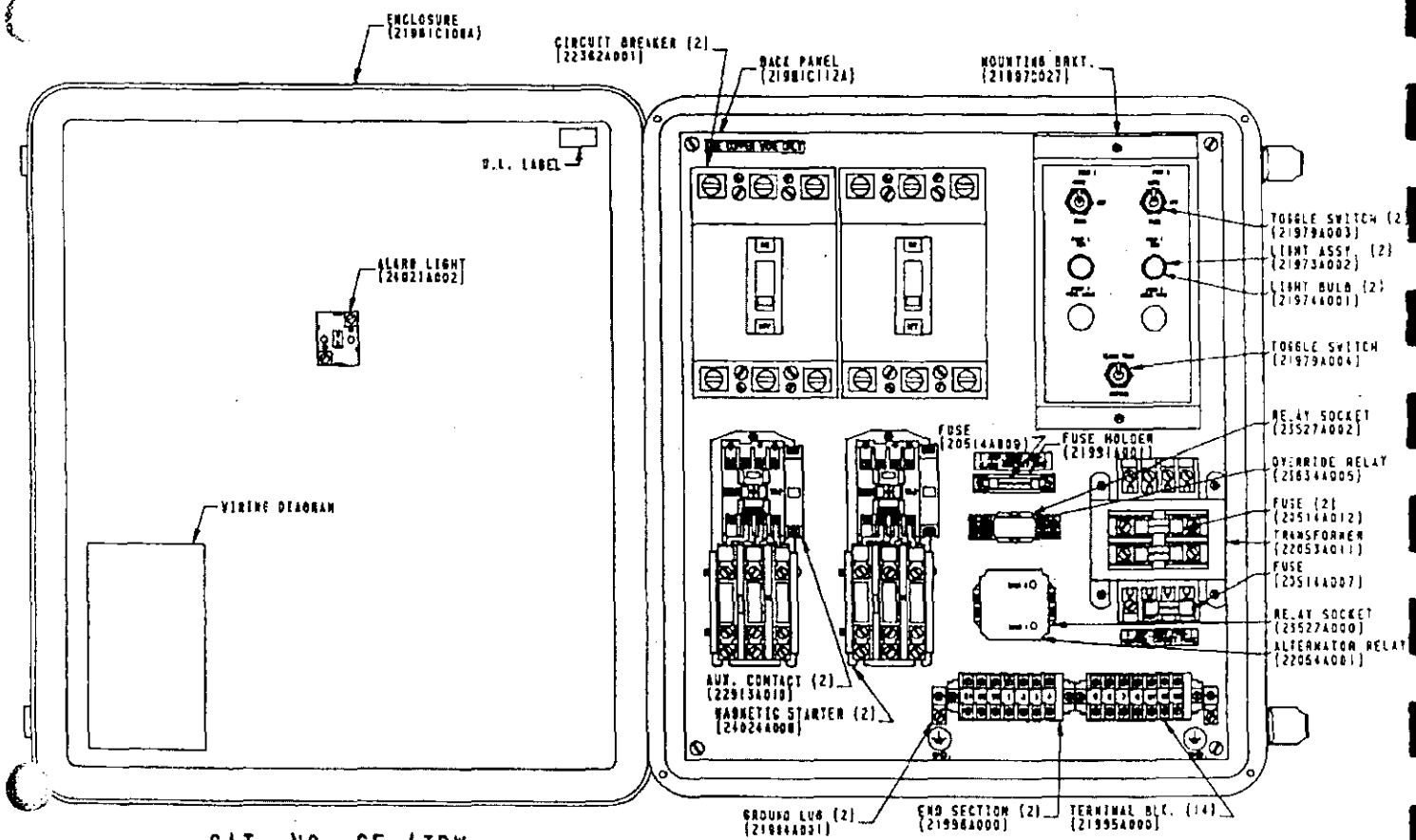




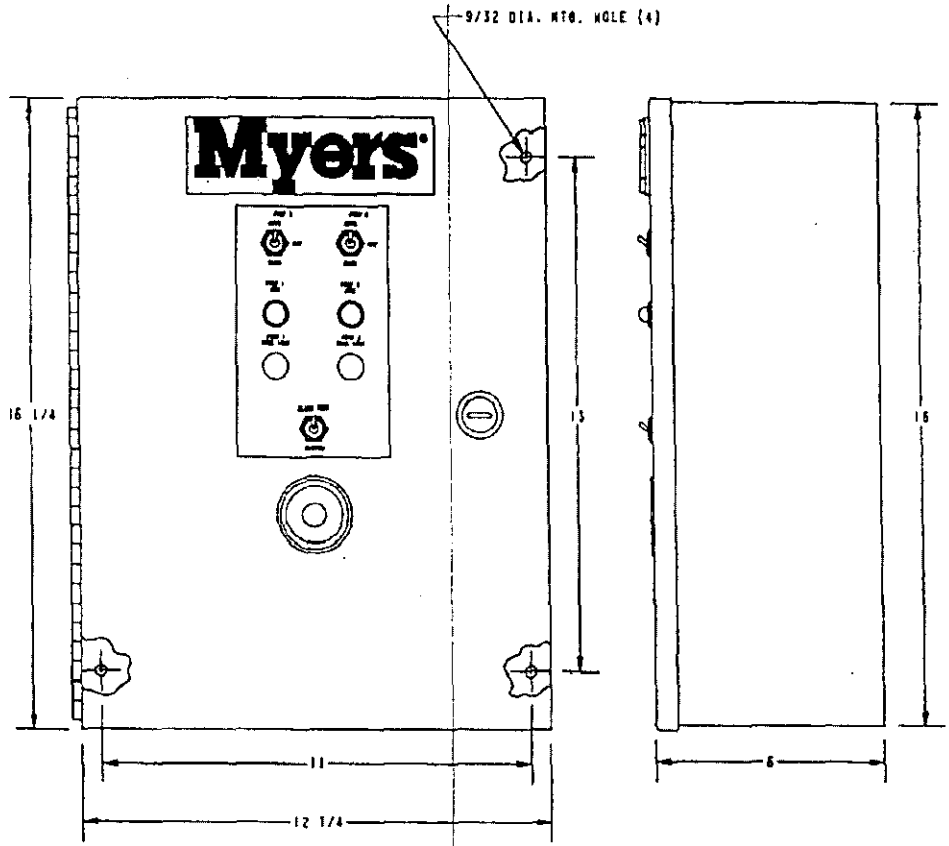
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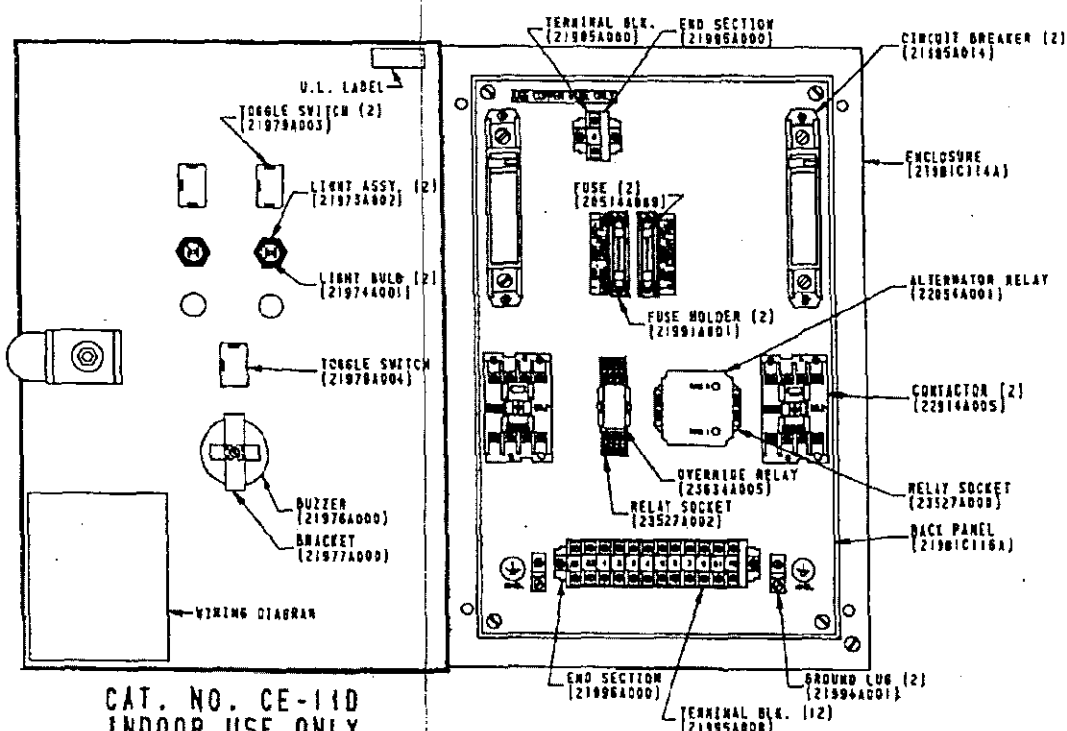
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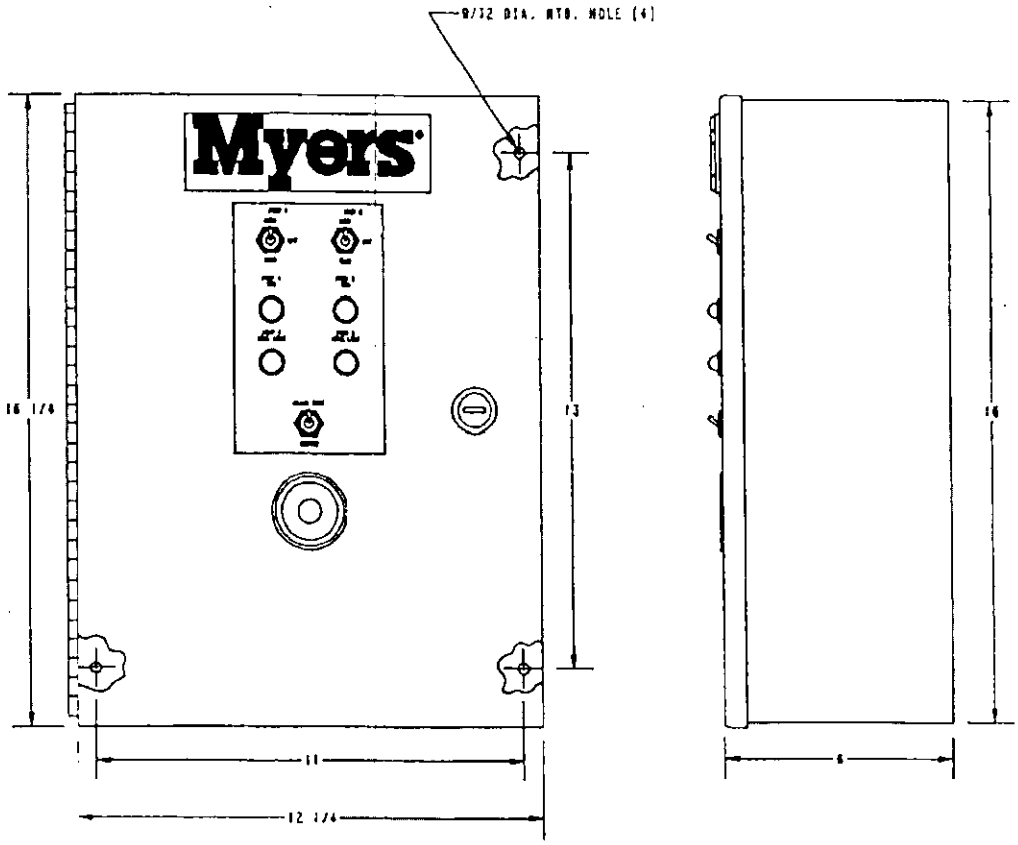


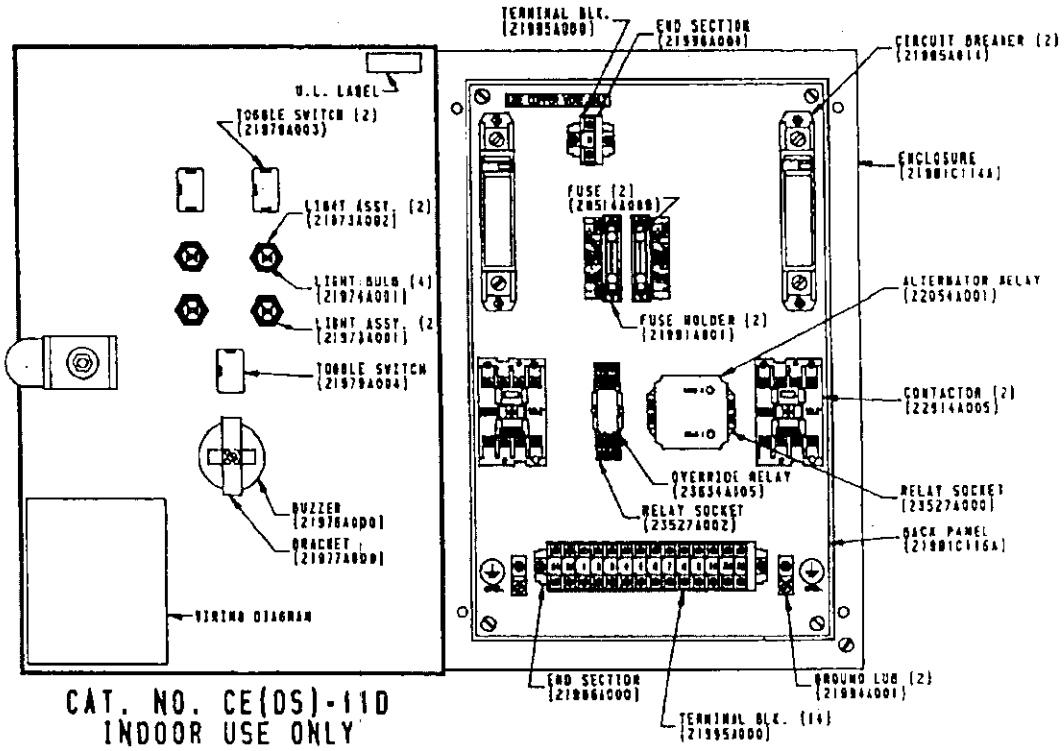
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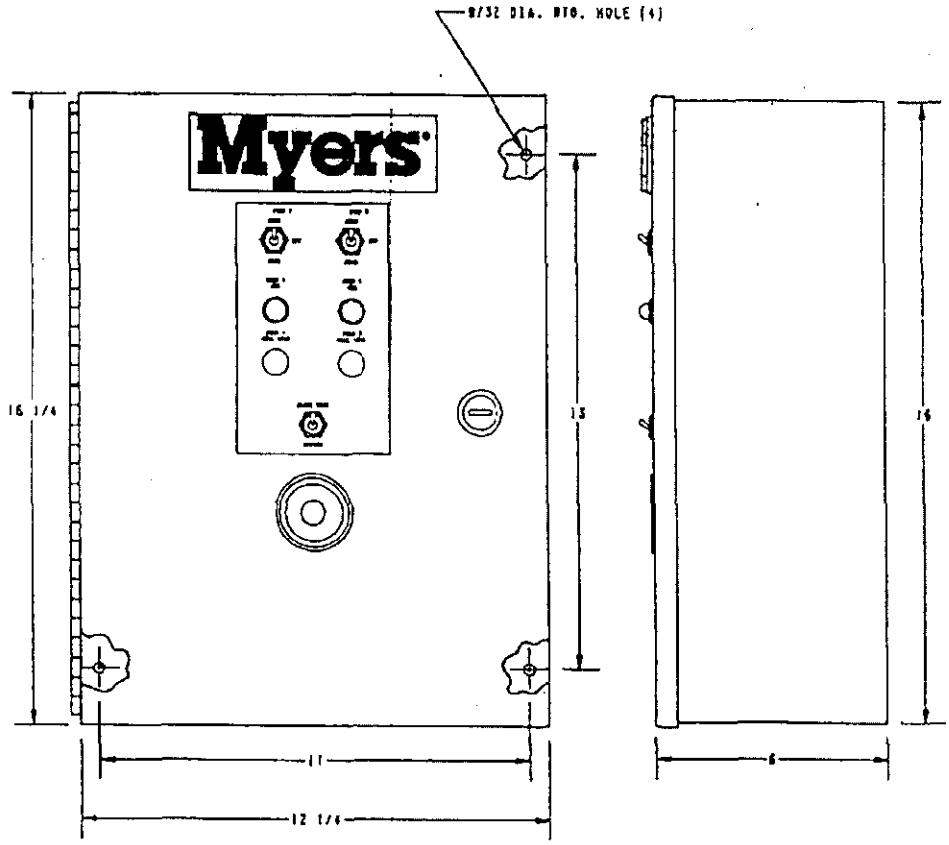


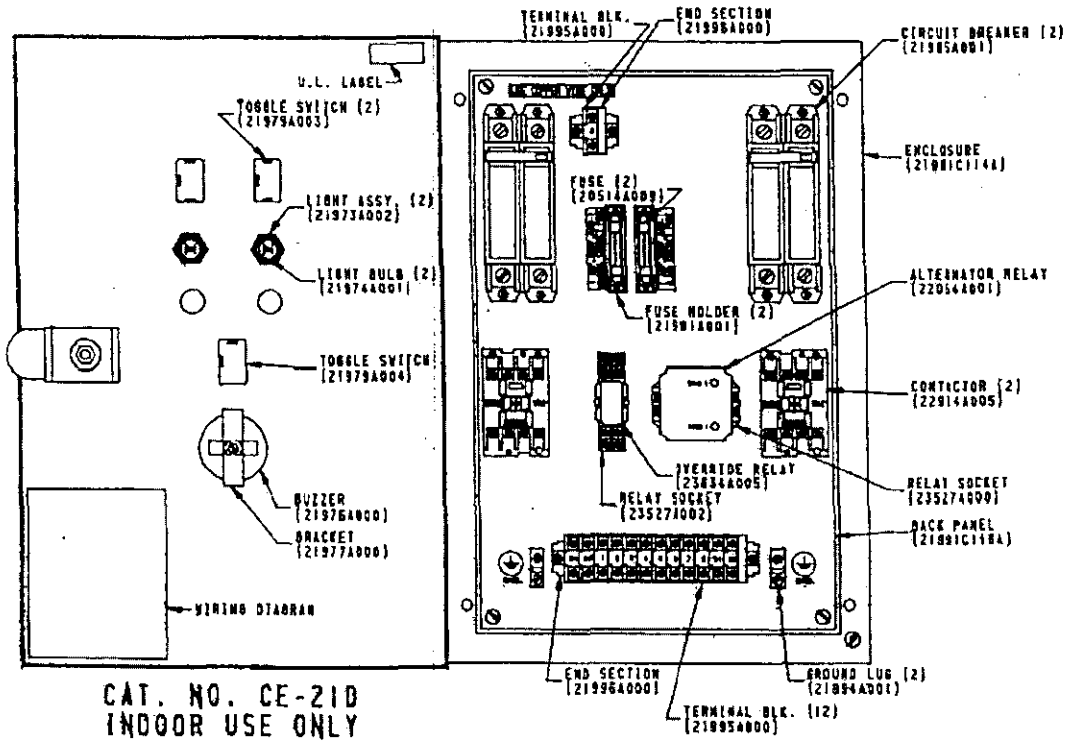
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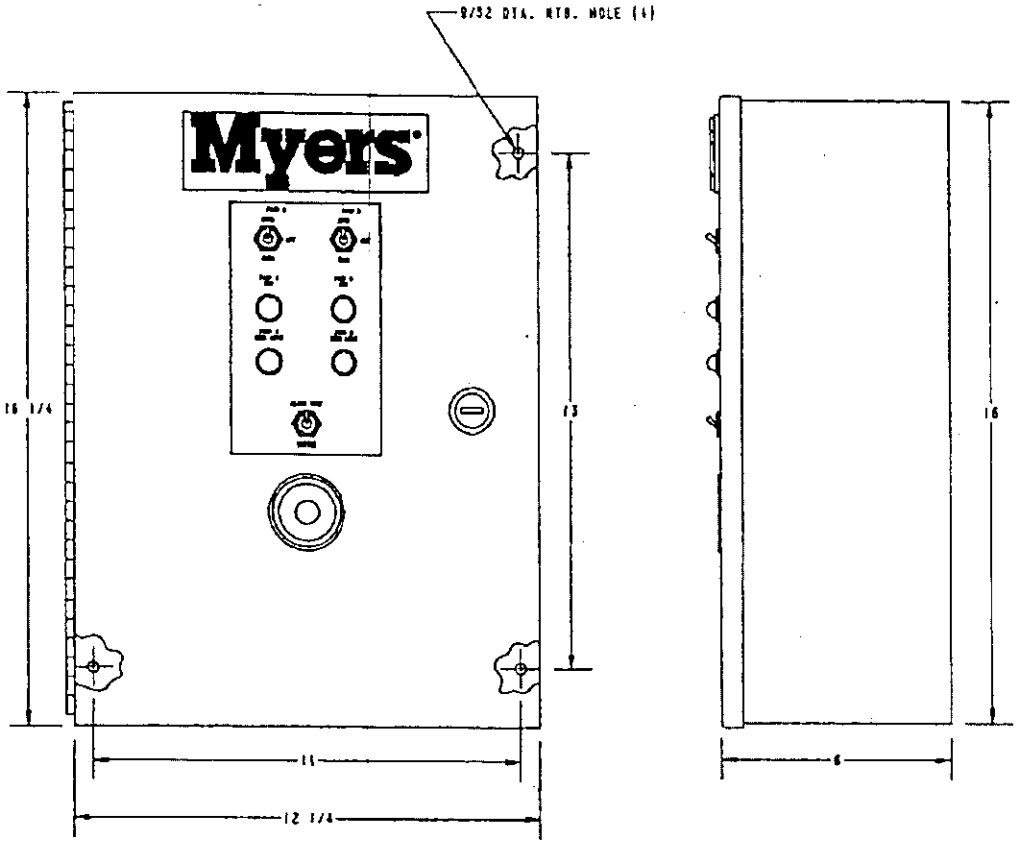


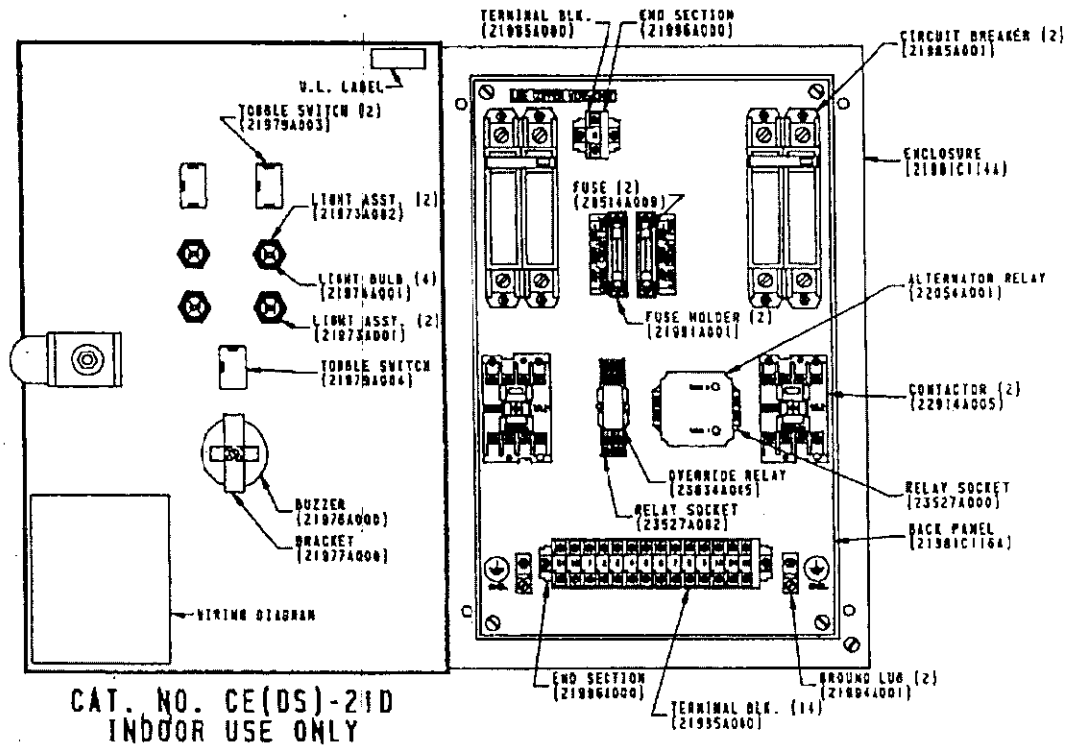
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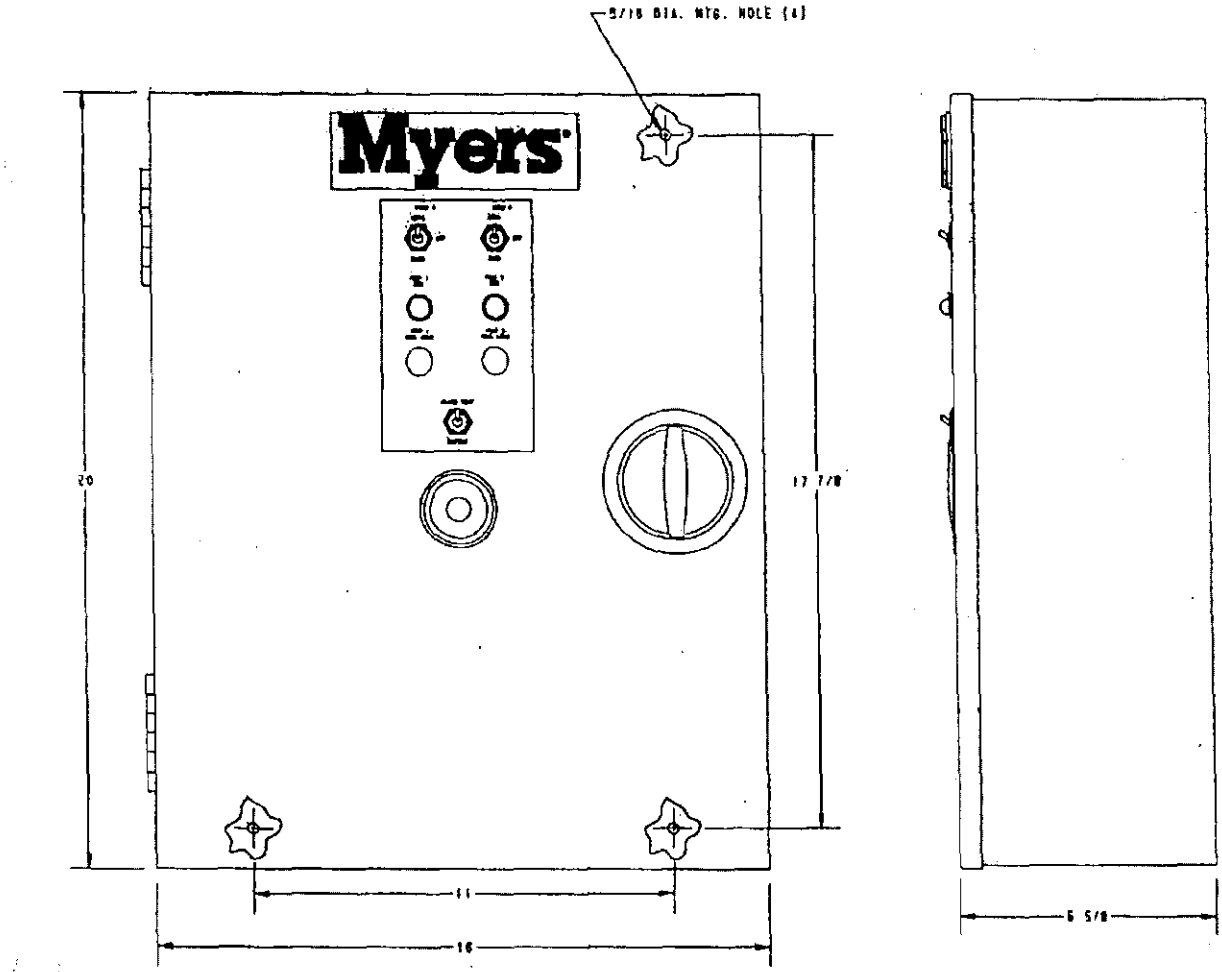


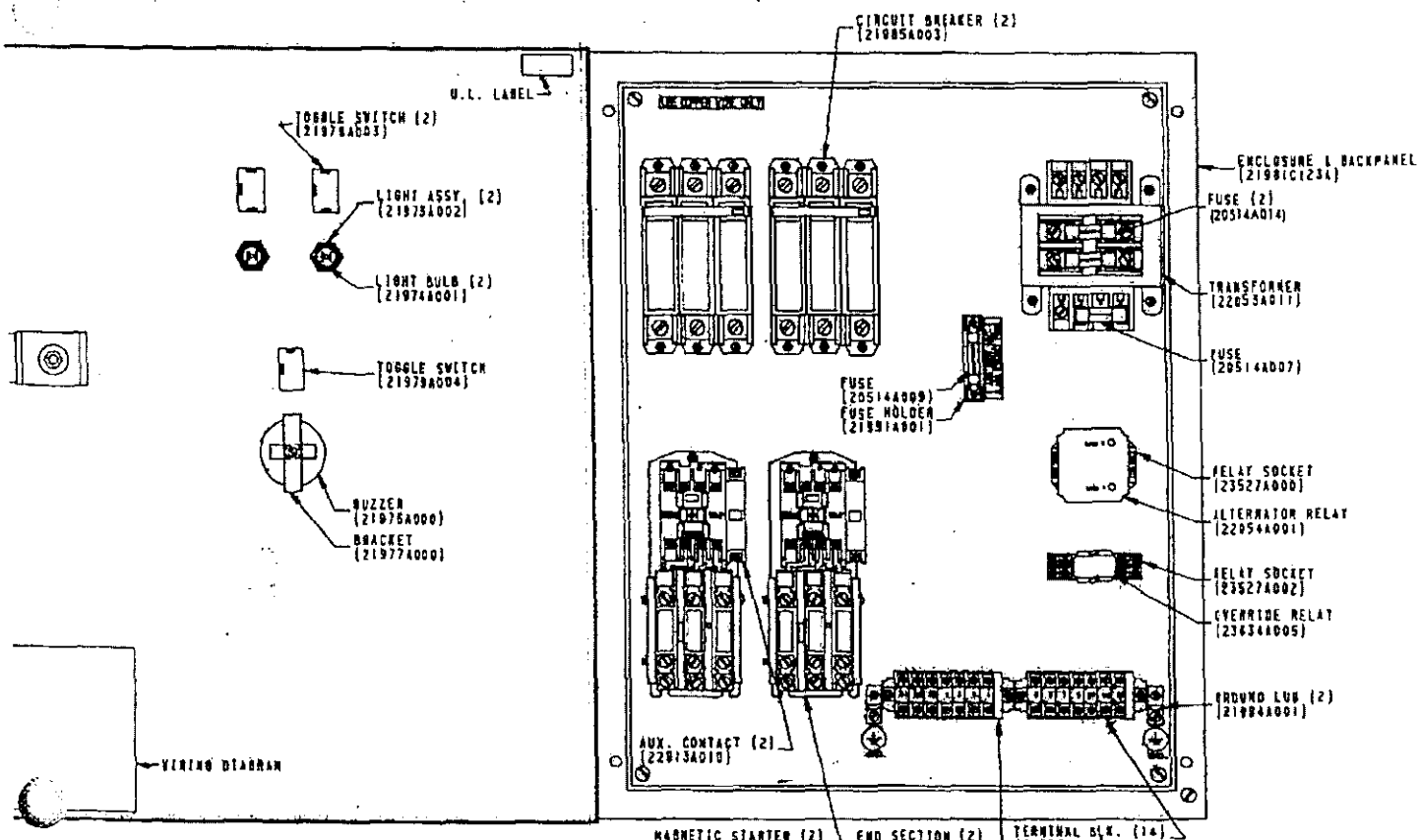
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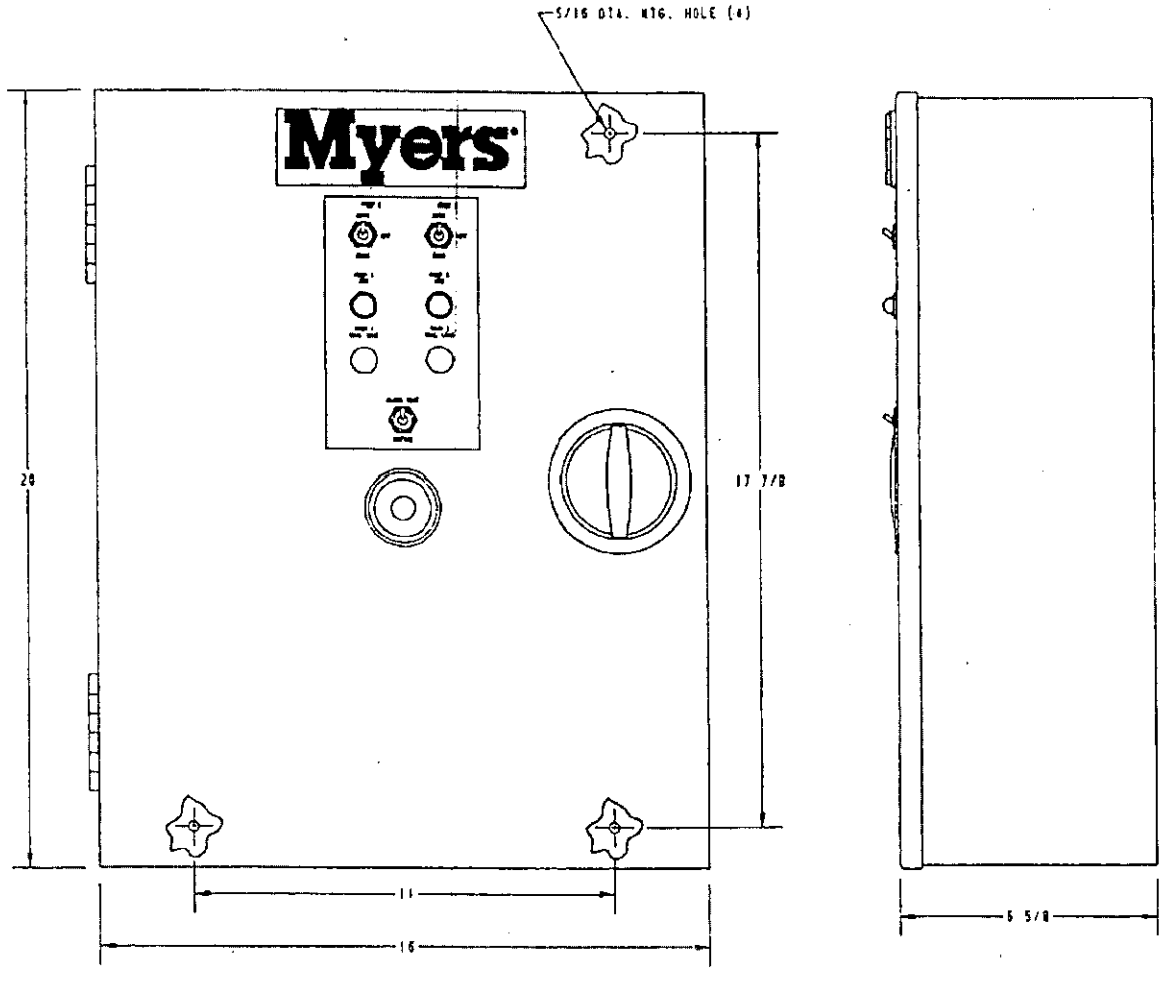


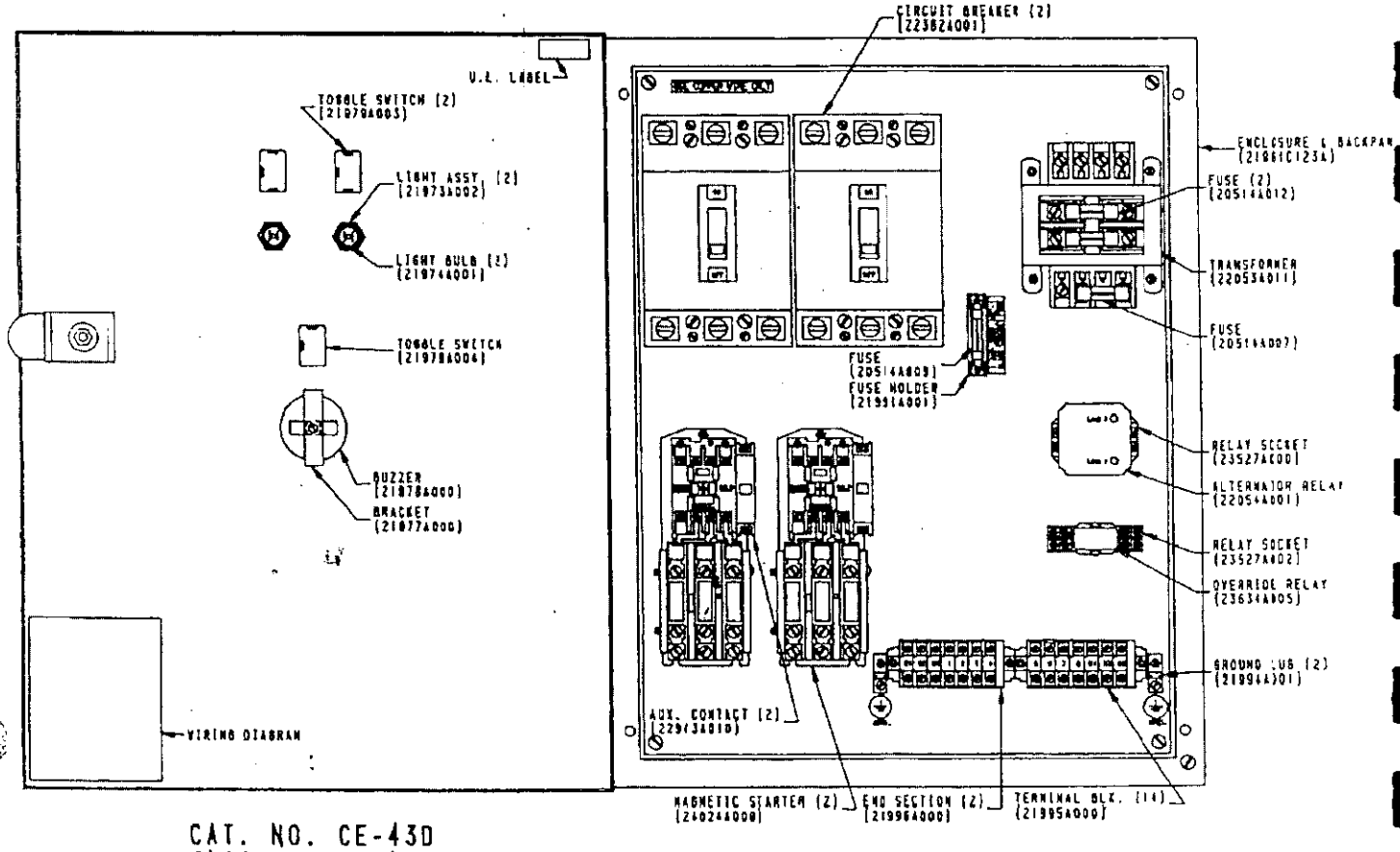


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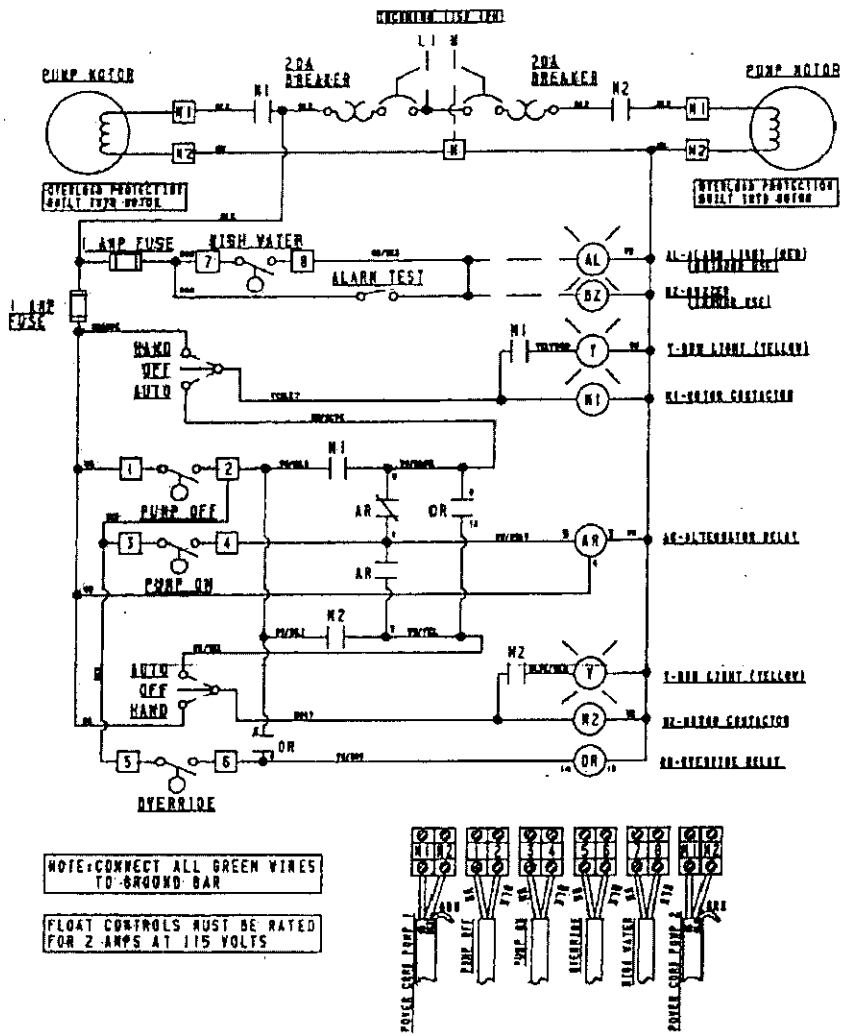




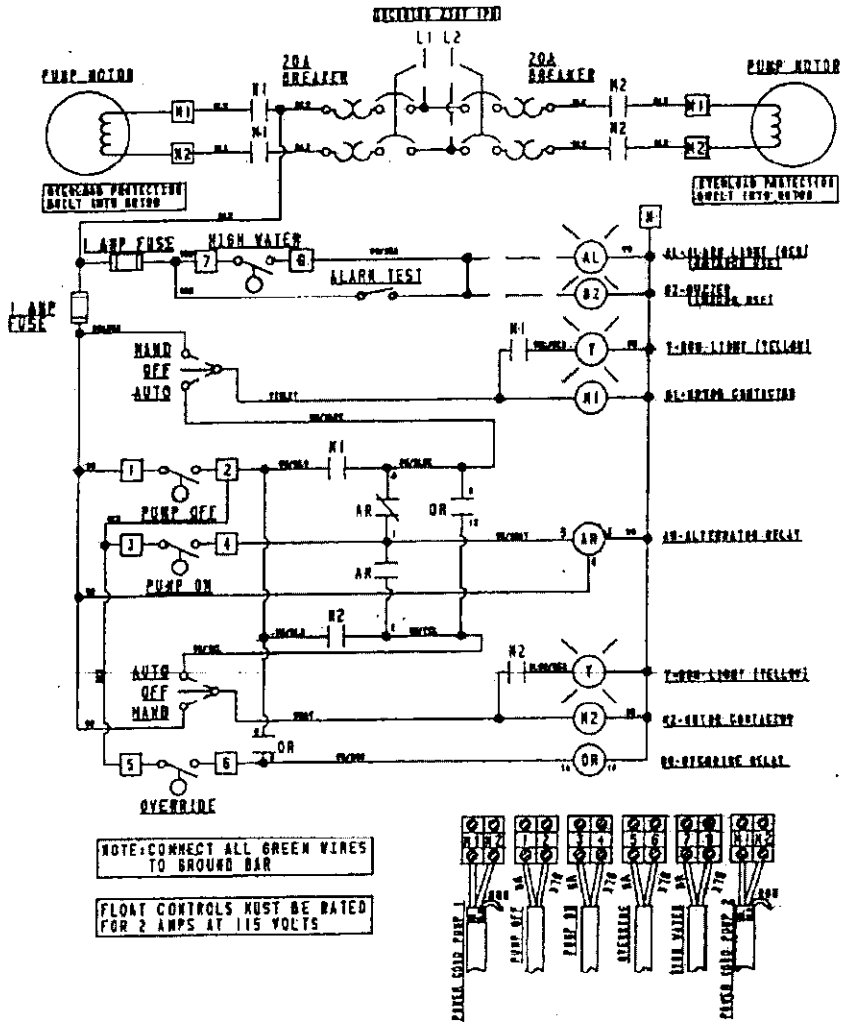
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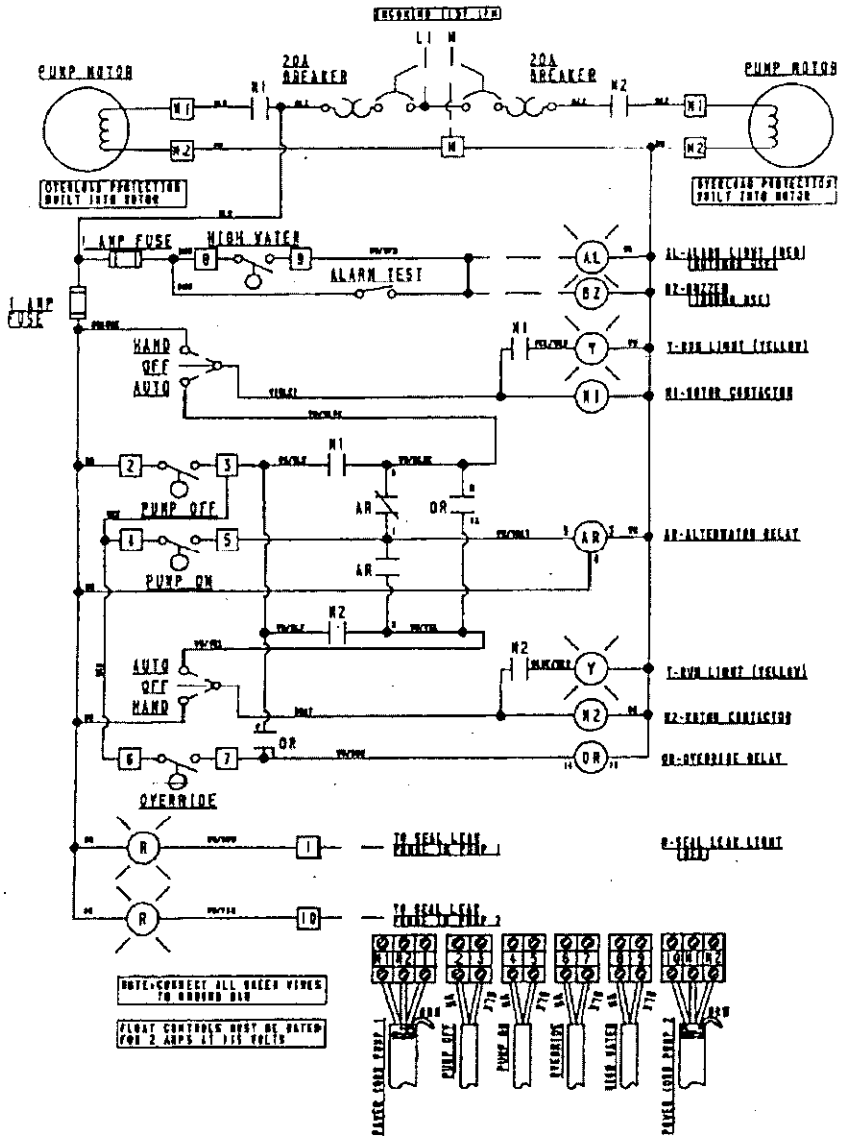
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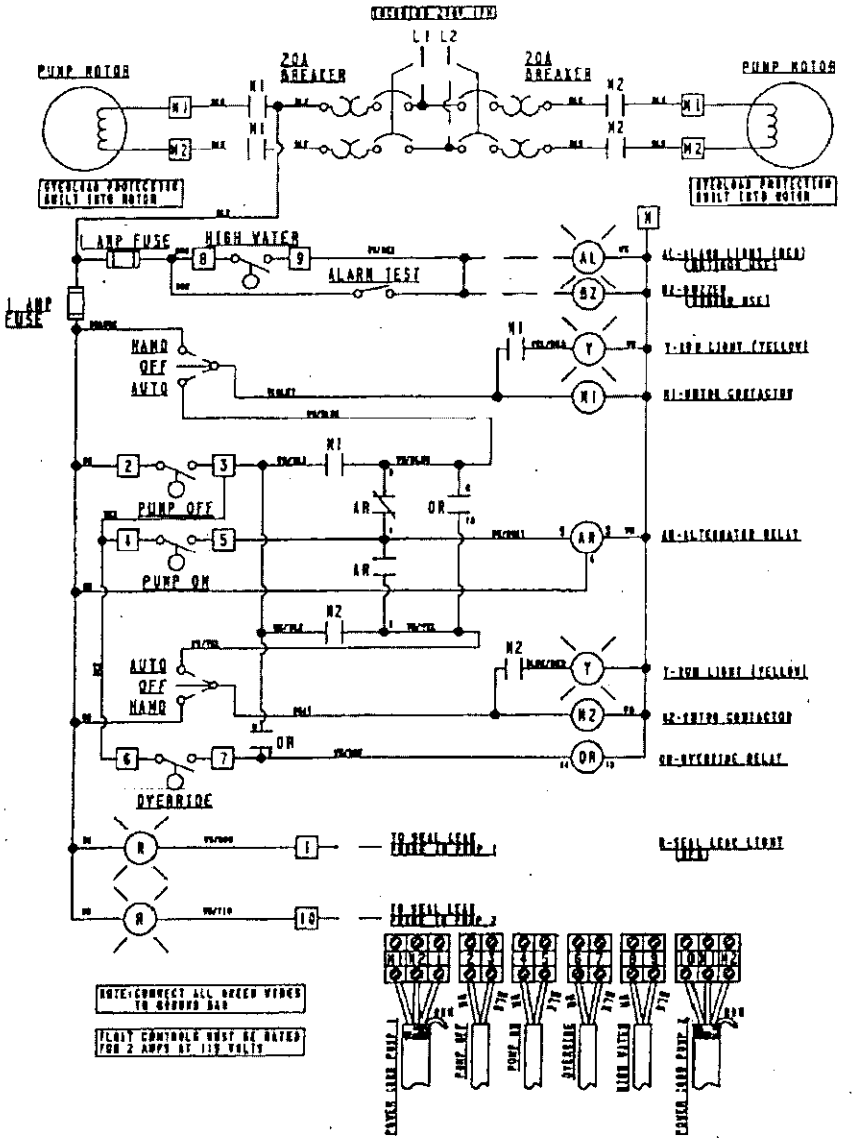
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115 VOLT, 1 PHASE



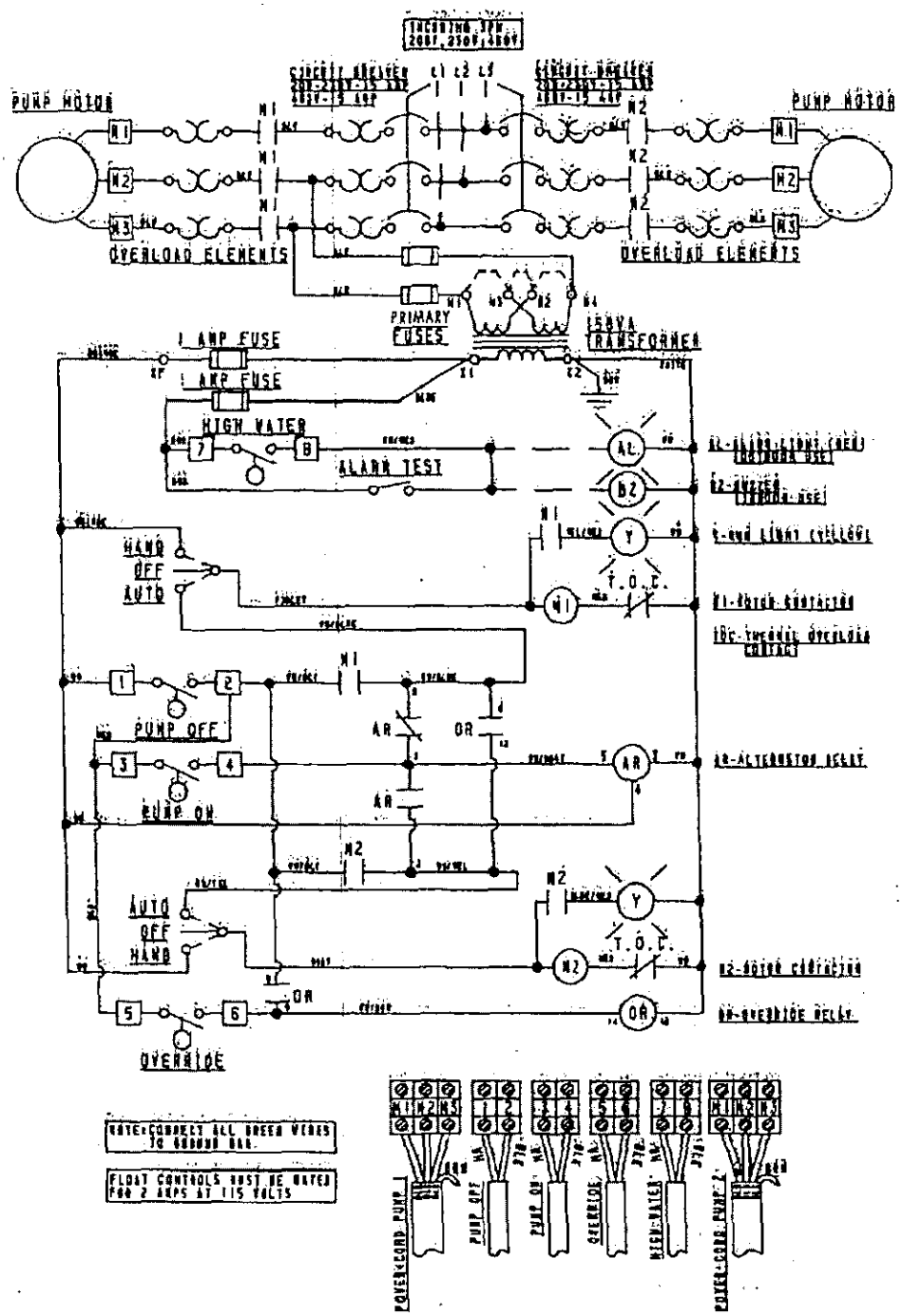
CAT. NO. CE-21D OR CE-21DW
230 VOLT, 1 PHASE



CAT. NO. CE(DS)-11D OR CE(DS)-11DW
115 VOLT, 1 PHASE



CAT. NO. CE(DS)-21D OR CE(DS)-21DW
230 VOLT, 1 PHASE



CAT. NO. CE-23D, CE-43D, CE-23DW OR CE-43DW
208, 230 OR 460 VOLT, 3 PHASE

Myers®

LIMITED WARRANTY

The F.E. Myers Co. warrants the pump, electrical controls, and all system components to be free of defects in material and workmanship for one year from date of installation, providing it is within 18 months from date of manufacture.

The F.E. Myers Co. will repair or replace directly or through its agents defective parts free of charge within the warranty period.

Warranty does not cover labor to remove or replace the equipment and does not include freight, consequential or incidental damage.

Misuse or abuse of the equipment is not covered by the warranty.

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23833A149 2/90

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APPENDIX M

PRESSURE TRANSDUCER CALCULATIONS

Pressure transducers measure ambient pressure, which, in conjunction with a local datum (the top of the pipe), allows for the calculation of the height of the water over the transducer. This was completed by subtracting the datum (distance from the top of the pipe to the top of the transducer) from the elevation of the top of pipe and adding the recorded height of water above the transducer. As the transducers measure absolute pressure (water pressure + atmospheric pressure), the atmospheric pressure, recorded by the barometric pressure logger, is subtracted to compensate for the influence of changing barometric pressures on the water level readings. This compensated reading is the height of the water column within the diesel recovery trench. A level survey was conducted to establish reference elevations at this discharge location. Elevations of required variables, including the top and bottom of the diesel recovery trench discharge pipe and the top and bottom of the pipe and block transducer housing, were surveyed with level loops closed within an acceptable level of error. The survey benchmark used in the west end was the top of the cement control structure at the west end. The reference elevations, in addition to the ambient pressure data points (corrected for atmospheric pressure), allow for the determination of the height of water in relation to the discharge pipe in the west end. Since the compensated height of water is known and the discharge pipe size and slope are measured, then a flow rate can be calculated using Manning's Equation, which is presented below.

$$Q = VA = \left(\frac{K_n}{n}\right) AR^{\frac{2}{3}}\sqrt{S}$$

where: n= the interior surface of the pipe, in this case PVC which uses the constant 0.012

S= the slope of the water, in this case 0.001 %

K_n = *Manning's Equation* Conversion Factor (for Metric calculations K_n = 1/sec)

A = the area (in meters^2) of water within the pipe determined by:

$$A = \frac{[\theta - \sin(\theta)](D)^2}{8}$$

R = The Hydraulic Radius (in meters) is determined by:

$$R = \left[\frac{(\theta - \sin\theta)}{\theta}\right]\left[\frac{D}{4}\right]$$

D = Diameter of the pipe (m)

$$\theta = \pi + 2(\sin^{-1})\left[\left(\frac{(2)(h_2)}{D}\right) - 1\right]$$

h_2= h_1 -height (in meters) of pipe base

h_1 = Initial transducer height (in meters) below water line + compensated height of water above transducer

Measurements from the west end effluent stream are collected during the operating year. Recorded water depths and barometric pressure are transferred to an excel spreadsheet, which is used to calculate flows from the west end location based on the specific flow formulae developed. The median calculation is used to describe the central tendency of flow data due to the skewed nature (non normal distribution) of flow, and was chosen over the mean because the median is not impacted by extreme values in the data sets. Daily, weekly, and monthly statistical values, summarizing the median, 25th percentiles, and 75th percentiles are generated and used for comparisons of the spread between data sets, as it is less affected by extreme values in the data sets compared to the range.

Calibration will consist of taking physical measurements of flow by using a calibrated twenty (20) L pail. Five (5) separate measurements will be collected and the median value will be recorded as the flow rate. This value will then be compared to calculated flow and used to ensure that the calculated flow is within 20% of the actual flow rate.

APPENDIX N

CERTIFICATE OF APPROVAL NO. 3528-83LQWT

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDED CERTIFICATE OF APPROVAL
INDUSTRIAL SEWAGE WORKS
NUMBER 3528-83LQWT
Issue Date: April 29, 2010

Canadian National Railway Company
1 Administration Road
PO Box, No. 1000, Concord, Ontario L4K 1B9

Site Location: 58 Front Street - Hornepayne Yard
East and West End Systems
Hornepayne Township, District of Algoma, ON P0M 1Z0

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

the establishment of sewage works for the collection, transmission, treatment and disposal of stormwater, contact stormwater runoff from the CN Hornepayne Yard and industrial sewage generated from the Lagoon Light Non-Aqueous Phase Liquid (LNAPL) Containment System, the Shop Track LNAPL Recovery System, the Waste Oil Transfer Facility and melt water/seepage from the soil contaminated cell, discharging to Little Jackfish River, consisting of the following:

EAST END ENVIRONMENTAL PROTECTION SYSTEM

- A Lagoon System to provide quantity and quality controls for both stormwater runoff, off-site discharge of petroleum hydrocarbon spills and industrial sewage. The lagoon consists of:

  - a rectangular lagoon with an impermeable liner for a total capacity of approximately 1,936 m^3, discharging to a 600 mm diameter corrugated steel pipe with an outlet at an elevation of 322.74 m, equipped with a 900 mm diameter concrete manhole acting as an settling basin for hydrocarbon and suspendid solids.

  - an increase in the lagoon berm height by 0.8 m, including 0.3 m of freeboard, to increase the volumetric capacity 835 m^3 for a total capacity of 2,771 m^3, and slopes changes from 3:1 to 4:1.

- A Containment Recovery and Collection System to contain and recover local subsurface LNAPL identified in the area, consisting of:

  - A bentonite / concrete cut-off wall at the northwest corner of the lagoon to prevent the off-site migration of LNAPL into the Little Jackfish River, equipped with ten (10) pumping wells and an interception trench with 4.5 m depth, width of 0.6 to 1.1 m and 78.5 m in length, all located between the former Pump House area and the Little Jackfish River (upgradient and downgradient from the cut-off wall), and discharging into

the oil/water separator.

- An oil/water separator (fiberglass Parkson Model SRM6 OWS, or approved equivalent) located at the Pollution Control Building and discharging into the lagoon, equipped with:

- A transfer tank with a total capacity of 171 L, a transfer pump directing sewage from the transfer tank to a 4,560 L double walled waste oil tank located adjacent to the Pollution Control Building, prior to treatment at the Oil Transfer Facility.

- A Shop Track LNAPL Recovery System to contain and recover local subsurface LNAPL identified in the area, consisting of:

  - An oil skimmer, Abinaki Model 8 Oil Grabber, used to collect LNAPL draining to the Recovery Trech.

  - A rock filled Recovery Trench (20 m long, 5 m wide and 5 m depth) with a non woven geotextile to collect groundwater and LNAPL to be pumped through a 38 mm diameter HDPE discharge line to the oil water separator located at the waste oil transfer facility. This System is equipped with a collection sump located within the Pollution Control Building, transferring collected LNAPL, by gravity, to the oil recovey tank.

  - An oil recovey tank, double walled with a capacity of 5,000 L.

- A Waste Oil Transfer Facility to process petroleum hydrocarbons collected from all LNAPL collection systems within the Yard, as well as waste oil generated from both Yard and remote site operations, consisting of a waste oil holding tank of 38 m^3 double walled discharging to the oil water separator and an oil water separator.

- A Soil Containment Cell to contain hydrocarbon impacted soils generated from former and future spills within the Yard and at remote rail locations, consisting of a circular cell with a non permeable liner with a holding capacity of 13,600 m^3, equipped with a rubber tire excavator to treat top soil at 0.3 to 0.5 m depth.

All other controls, electrical equipment, instrumentation, piping, pumps, valves and appurtenances essential for the proper operation of the aforementioned sewage works.

WEST END FUELLING STAND SYSTEM

These works include the West End Fuelling Stand at the Hornepayne Yard and included in Certificate 5146-7F2H6J issued on June 17, 2008, consisting of the following:

- Approximately eleven (11) 50 mm diameter perforated pipe underdrains installed under the trackage adjacent to the West End Fuelling Platform and the contaminated soil stockpile, discharging to the retention lagoon;

- One (1) retention lagoon with a storage capacity of approximately 960 m^3 (at the maximum operating water elevation of 324.4 m), including a sheet pile weir and belt oil skimmer seasonally operated

(normally April to November) with product recovery storage tank, discharging to the lined drainage ditch;

- One (1) polyvinyl chloride lined drainage ditch extending from the retention pond to the Little Jackfish River, including the relocation of the existing concrete discharge control structure;

All other controls, electrical equipment, instrumentation, piping, valves and appurtenances essential for the proper operation of the aforementioned sewage works

All in accordance with the following submitted supporting documents:

1. Application for Approval of Industrial Sewage Works submitted by Alexandre Borges, CN Environment Officer of Canadian National Railway Company dated August 4, 2009;

2. Application's appendix A to H prepared by KGS Group Consulting Engineers, dated August 10, 2009.

3. Application for the Approval of Industrial Sewage Works submitted by Mr. Erwin Waldinsperger dated January 1998 and attachments and associated drawings, all prepared by KGS Group Consulting Engineers.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

"Certificate" means this entire certificate of approval document, issued in accordance with Section 53 of the *Ontario Water Resources Act* , and includes any schedules;

"Director" means any Ministry employee appointed by the Minister pursuant to section 5 of the *Ontario Water Resources Act* ;

"District Manager" means the District Manager of the Thunder Bay District Office of the Ministry;

"Ministry" means the Ontario Ministry of the Environment;

"Regional Director" means the Regional Director of the Northern Region of the Ministry;

"Source Protection Plan" means a drinking water source protection plan prepared under the *Clean Water Act, 2006* ;

"Owner" means Canadian National Railway Company and includes its successors and assignees; and

"works" means the sewage works described in the Owner's application, this certificate and in the supporting documentation referred to herein, to the extent approved by this certificate.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL CONDITION

(1) Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the works in accordance with the description given in this Certificate, the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this Certificate.

(2) Where there is a conflict between a provision of any submitted document referred to in this Certificate and the Conditions of this Certificate, the Conditions in this Certificate shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

2. CHANGE OF OWNER

(1) The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within 30 days of the change occurring:

(a) change of Owner or operating authority, or both;

(b) change of address of Owner or operating authority or address of new owner or operating authority;

(c) change of partners where the Owner or operating authority is or at any time becomes a partnership, and a copy of the most recent declaration filed under the *Partnerships Registration Act* ;

(d) change of name of the corporation where the Owner or operator is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" (Form 1, 2 or 3 of O. Reg. 189, R.R.O. 1980, as amended from time to time), filed under the *Corporations Information Act* shall be included in the notification to the District Manager;

(2) In the event of any change in ownership of the works, the Owner shall notify in writing the succeeding owner of the existence of this certificate, and a copy of such notice shall be forwarded to the District Manager.

(3) The Owner shall ensure that all communications made pursuant to this condition will refer to this certificate's number.

3. CHANGES IN PROCESSES OR PROCESS MATERIALS

The Owner shall give written notice to the District Manager of any plans to change the processes or process materials in the Owner's enterprise serviced by the works where the change may significantly

alter the quantity or quality of the influent to or effluent from the works, and no such change(s) shall be made unless with the written concurrence or approval of the District Manager.

4. OPERATIONS MANUAL

(1) The Owner shall prepare an operations manual prior to the commencement of operation of the sewage works, that includes, but not necessarily limited to, the following information:

(a) operating procedures for routine operation of the works;

(b) inspection programs, including frequency of inspection, for the works and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair/maintenance;

(d) contingency plans and procedures for dealing with potential spill, bypasses and any other abnormal situations and for notifying the District Manager; and

(e) complaint procedures for receiving and responding to public complaints.

(2) The Owner shall maintain the operations manual up to date through revisions undertaken from time to time and retain a copy at the location of the sewage works. Upon request, the Owner shall make the manual available for inspection and copying by Ministry personnel.

5. EFFLUENT LIMITS

(1) The Owner shall design, construct and operate the works that discharge to the Little Jackfish River such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent from the works.

Table 2 - Effluent Limits	
Effluent Parameter	**Concentration Limit (mg/L)**
Column 1	Column 2
Petroleum Hydrocarbons (F1+F2)	1000
Petroleum Hydrocarbons (F3+F4)	1000
Benzene	5
Toluene	0.8
Ethylbenzene	2.4
m&p-Xylene	32
o-Xylene	40
Methyl-t-butyl-Ether (MTBE)	200
Lead	See subsection 2
pH of the effluent maintained between 6.5 to 8.5, inclusive, at all times	

(2) The limit for Lead shall be determined based on the hardness of the water. If the hardness is less than 30 mg/L, the limit is 1 µg/L. If the hardness is between 30 mg/L and 80 mg/L, inclusive, the limit is 3 µg/L. If the hardness is greater than 80 mg/L, the limit is 5 µg/L.

(3) For the purposes of determining compliance with and enforcing subsection (1):

(a) non-compliance with respect to a Concentration Limit is deemed to have occurred when any single sample analyzed for a parameter named in Column 1 of subsection (1) is greater than the corresponding maximum concentration set out in Column 2 of subsection (1);

(b) non-compliance with respect to pH is deemed to have occurred when any single measurement is outside of the indicated range.

6. EFFLUENT - VISUAL OBSERVATIONS

Notwithstanding any other condition in this certificate, the Owner shall ensure that the effluent from the works is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film, sheen or foam on the receiving waters.

7. EFFLUENT MONITORING - SURFACE WATER

(1) All samples and measurements taken for the purposes of this certificate are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.

(2) Samples shall be collected and analyzed at the following sampling point(s), at the sampling frequencies and using the sample type specified for each parameter listed:

Table 3 - Effluent Monitoring - Surface Water

Sample Points: To be established to the satisfaction of the District Manager prior to commencement of operations of the works. Sampling includes estimated flows. Sampling locations at a minimum to include (as per Drawing No. 09-0434-01 H1, Rev. A, Appendix H of the Application package dated August 2009, prepared by KGS Group):

1. Effluent from Discharge Control Gate;
2. Little Jackfish River: HOR 005 05 (mid stream); and HOR 004 05 (down stream)
3. Yard discharge: HOR 002 05 (Lagoon No.2), at the end of the discharge culvert.

Frequency	Once each month (April to November) in ice-free conditions
Sample Type	Grab
Parameters	Petroleum Hydrocarbons (F1+F2), Petroleum Hydrocarbons (F3+F4), Benzene, Toluene, Ethylbenzene, m&p-Xylene, o-Xylene, Methyl-t-butyl-Ether (MTBE), Lead, pH, hardness, alkalinity, Total Purgeable Hydrocarbons, Total Extractable Hydrocarbons, Total Oil and Grease, and Mineral Oil and Grease

(3) The Owner shall supplement the monitoring program in subsection (1) with visual inspections which shall include, but not be limited to the following:

(a) A weekly inspection (April to November) of the effluent from the Discharge Control Gate and the river during discharge of treated wastewater for any visible oil sheens, colour and odours; and

(b) A weekly inspection (April to November) of the level of material in the recovered product storage tank.

(4) The methods and protocols for sampling, analysis, toxicity testing, and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(a) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (August 1994), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions;

(b) the publication "Standard Methods for the Examination of Water and Wastewater" (21st edition) as amended from time to time by more recently published editions; and,

(c) the Environment Canada publications "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout" (July 1990) and "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna" (July 1990);

(5) The measurement frequencies specified in subsection (2) in respect of any parameter are minimum requirements which may, after twelve (12) months of monitoring in accordance with this Condition, be modified by the District Manager in writing from time to time.

(6) A continuous flow measuring device(s) or an alternate method approved by the District Manager shall be installed and maintained to measure the flowrate of the effluent from the sewage works, with an accuracy to within plus or minus twenty per cent (20%) of the actual flowrate for the entire design range of the flow measuring device and the Owner shall measure, record and calculate the flowrate for each effluent stream on each day of sampling.

8. EFFLUENT MONITORING - GROUNDWATER

(1) All samples and measurements taken for the purposes of this certificate are to be taken at a time and in a location characteristic of the quality and quantity of the groundwater over the time period being monitored.

(2) Samples shall be collected and analyzed at the following sampling point(s), at the sampling frequencies, including groundwater levels and thickness of any light non-aqueous phase liquids (LNAPLs) using an interface probe (IP) at all monitoring wells:

Table 3 - Effluent Monitoring - Groundwater Sample Points: Sampling locations as per Drawing No. 09-0434-01 G1, Rev. A, Appendix G of the Application package dated August 2009, prepared by KGS Group).		
Effluent Parameter	**Frequency**	**Sample Location**
Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), and Hydrocarbon fraction F1	Monitored and sampled once per year	Wells: MW-20, MW-40, MW-43, MW-46, MW-52, OW 5-1, OW 5-2 and OW 5-3
Hydrocarbon fraction F2 to F4	Monitored twice per year (Spring and Fall)and Sampled once per year	Wells: MW-21, MW-24, MW-49, MW-51, MW-52, MW-101, MW-102, MW-103, MW-104, MW-106, MW-107, MW-108, MW-109, MW-114, MW-115, MW-126, and OW 3-2
Hydrocarbon fraction F2 to F4	Monitored and sampled twice per year (Spring and Fall)	Wells: MW-20, MW-40, MW-43, MW-46, MW-52, OW 5-1, OW 5-2 and OW 5-3

Note: Duplicate groundwater samples shall be taken for field monitoring of Dissolved Oxygen, pH, Conductivity, Temperature and Oxidation-reduction potential.

(3) The methods and protocols for sampling, analysis, toxicity testing, and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(a) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (August 1994), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions.

(b) the publication "Standard Methods for the Examination of Water and Wastewater" (21st edition) as amended from time to time by more recently published editions.

(5) The measurement frequencies specified in subsection (2) in respect of any parameter are minimum requirements which may, after twelve (12) months of monitoring in accordance with this Condition, be modified by the District Manager in writing from time to time.

9. REPORTING

(1) The Owner shall report to the District Manager or designate, any exceedance of any parameter specified in Condition 6 orally, as soon as reasonably possible, and in writing within seven (7) days of the exceedance.

(2) In addition to the obligations under Part X of the *Environmental Protection Act* , the Owner shall, within 10 working days of the occurrence of any reportable spill as defined in Ontario Regulation 675/98, bypass or loss of any product, by-product, intermediate product, oil, solvent, waste material or any other polluting substance into the environment, submit a full written report of the occurrence to the District Manager describing the cause and discovery of the spill or loss, clean-up and recovery measures taken, preventative measures to be taken and schedule of implementation.

(4) The Owner shall prepare and submit a performance report to the District Manager on an annual basis within thirty (30) days following the end of the period being reported upon. The first such report shall cover the first annual period following the commencement of operation of the works and subsequent reports shall be submitted to cover successive annual periods following thereafter. The reports shall contain, but shall not be limited to, the following information:

(a) a summary and interpretation of all monitoring data and a comparison to the effluent limits outlined in Condition 5, including an overview of the success and adequacy of the sewage works;

(b) a description of any operating problems encountered and corrective actions taken;

(c) a summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the sewage works;

(d) a summary of any effluent quality assurance or control measures undertaken in the reporting period;

(e) a summary of the calibration and maintenance carried out on all effluent monitoring equipment;

(f) a site plan illustrating the location of all site infrastructure, environmental protection system components, monitoring wells and surface water monitoring stations;

(g) a location map illustrating the site relative to nearby potentially sensitive groundwater/surface water features (i.e., lakes, streams, wells);

(h) a water level contour map for each monitoring event carried out during the previous year;

(i) stratigraphic cross-sections which clearly illustrate the subsurface distribution of geological materials;

(j) boreholes logs for all monitoring wells;

(k) tables illustrating historical chemistry and water level data;

(l) graphs illustrating historical water quality trends for hydrocarbon parameters at key monitoring wells;

(m) an assessment of monitoring data to evaluate system effectiveness and compliance with the applicable water quality protection criteria;

(n) recommendations for future monitoring and/or further remedial actions;

(o) a section detailing the field sampling protocols and QA/QC measures;

(p) a copy of the Certificate of Approval and any amendments;

(q) copies of laboratory reports for all sampling events in that year; and

(r) all monitoring and sampling data should also be submitted in an electronic format (i.e. a Microsoft Excel spreadsheet).

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the works are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the Certificate and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.

2. Condition 2 is included to ensure that the Ministry records are kept accurate and current with respect to approved works and to ensure that subsequent owners of the works are made aware of the certificate and continue to operate the works in compliance with it.

3. Condition 3 is included to ensure that the works is operated in accordance with the information submitted by the owner relating to the process and materials which are served by the works, and to ensure that any contemplated changes in them which could potentially affect the characteristics of effluent from the works will be properly reviewed and approved.

4. Condition 4 is included to ensure that a comprehensive operations manual governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the owner and made available to the Ministry. Such a manual is an integral part of the operation of the works. Its compilation and use should assist the owner in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for Ministry staff when reviewing the owner's operation of the work.

5. Conditions 5 and 6 are imposed to ensure that the effluent discharged from the works to the Little Jackfish River meets the Ministry's effluent quality requirements thus minimizing environmental impact on the receiver.

6. Conditions 7 and 8 are included to require the owner to demonstrate on a continual basis that the quality and quantity of the effluent from the approved works is consistent with the design and effluent limits specified in the certificate and that the approved works does not cause any impairment to the receiving

watercourse.

7. Condition 9 is included to provide a performance record for future references and to ensure that the Ministry is made aware of problems as they arise, so that the Ministry can work with the Owner in resolving the problems in a timely manner.

This Certificate of Approval revokes and replaces Certificate(s) of Approval No. 5146-7F2H6J issued on June 17, 2008.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act , R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto, Ontario
M5G 1E5

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 29th day of April, 2010

Mansoor Mahmood, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

ET/

c: District Manager, MOE Sault Ste. Marie Area Office
Tony Gallo, Kontzamanis Graumann Smith MacMillan Inc.