Attachment 17

Trash Rake Specification

EA Engineering, Science, and Technology, Inc.

2350 Post Road
Warwick, RI 02886
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www.eaest.com

25 March 2009

TECHNICAL MEMORANDUM

TO: Megan Walter **LOCATION:** USDA-NRCS, RI

FROM: Tom Cook **LOCATION:** EA, Warwick, RI

SUBJECT: **Evaluation of Existing Trash Rake for Cleaning Replacement Trash Racks**
Pawtucket Hydropower Project at Main Street Dam
Blackstone River Fish Passage Restoration Project
NRCS Contract AG-1535-C-06-01, Task Order AG-1535-D-09-0002

The Natural Resources Conservation Service (NRCS) has requested that EA Engineering, Science, and Technology, Inc. (EA) evaluate the existing trash rake at the hydroelectric project at Main Street Dam on the Blackstone River for use in cleaning the replacement trash racks which are required for downstream fish passage. This evaluation is based on an inspection of the trash rake on 12 March 2009 and discussions with Pawtucket Hydro Power, LLC about debris loading conditions and concerns. In addition, the evaluation reflects input from Siemens Water Technologies Corporation, Hydrothane Systems, and Atlas Polar Company Ltd. Relative to trash rakes and trash racks.

EA's evaluation of the existing trash rake is presented below. Supporting data are provided in the following attachments:

Attachment 1	12 March 2009 Trash Rake Inspection
Attachment 2	Envirex Trash Rake Drawings
Attachment 3	13 March 2009 Notes of Meeting with Hydrothane Systems
Attachment 4	Communications Records
Attachment 5	Siemens Grab Rake Product Data
Attachment 6	Atlas Polar Quotation
Attachment 7	Atlas Polar Telescoping Boom Rake Product Data

Existing Trash Rake

The existing trash rake is a conventional style, heavy duty, traversing type trash rake originally manufactured by Envirex (a Rexnord Company). Siemens Water Technologies currently owns the Envirex trash rake products.

The existing trash rake was inspected on 12 March 2009 and found to be in good repair and mechanically acceptable for removing debris from the 2 in. clear opening, steel trash racks. Notes of the inspection are provided in Attachment 1. Drawings of the trash rake, which are in the Operating and Maintenance Manual that was provided by Charlie Rosenfield (Pawtucket Hydropower LLC), are presented in Attachment 2.

Conventional style rakes ride down the trash rack bars with the raking assembly open (teeth parallel to the rack bar). At the bottom of trash rack, the rake assemble is closed to engage the rake teeth between the rack bars approximately ½ in. to ¾ in. The existing rake teeth are spaced at 2 3/8 inches on-center and the wheel spacing on the raking assemble is approximately 7 ft - 9 in.

Replacement Trash Racks

The existing trash racks at Main Street Dam for Pawtucket Hydropower Project will be replaced with bar racks having 1-in. clear spacing during the downstream migration period and 2-in. clear spacing during the remainder of the year. Turbine flow would have to be limited to 900 cfs (450 cfs per unit) during juvenile downstream migration to maintain a maximum approach velocity of 2 ft/sec at the replacement trash racks.

The replacement trash racks will be fabricated from a plastic material similar to Hydrothanes HDPE racks. The racks will have three (3) panels with bars at 1-in. clear spacing and three (3) panels with bars at 2-in. clear spacing. Each replacement trash rack panel will be approximately 11 ft – 8 in. wide by 28 ft high. The limited overhead clearance in the building requires the full-depth panels to be stored in the forebay upstream of the abandoned intake openings. A monorail system attached to the existing roof beams will be used to install the panels for the different fish migration periods.

The replacement trash panels will be held in place by vertical steel guides extending from the bottom of the forebay up to the operating deck. The bottom of the panels will be inserted into a bottom channel connected to the existing steel trash rack bottom guide. The top of the panels will have a steel locking device that will extend over the tie rods located between the HDPE bars and bolted to the steel wear plate on the face of the concrete over the intake opening.

The replacement trash rack panels will be lifted using the tie rod/spacers between the HDPE bars. A steel support beam system will be installed on the bottom of the forebay upstream of the operating deck in front of the two existing bays that have been abandoned and have concrete plugs. Replacement trash rack panels that are being stored will sit on the support system and dogged to the operating deck.

EA met with Matt Brown from Hydrothane Systems on 13 March 2009 to discuss types of trash rakes that have been used on the high density polyethylene (HDPE) trash racks. Detailed notes of meeting are provided in Attachment 3.

Both conventional rakes and telescoping arm rakes have been used to clean the HDPE racks. With the HDPE racks, a wiper system is generally used on the rake instead of teeth. The wiper system can be adapted to any type of rake. However, as of the date of this memorandum, Hydrothane has not provided requested installation list and contact information for recent projects with HDPE racks and trash rakes.

The primary concern with the HDPE racks is the load on the rack bars applied by the raking assembly. The load includes both the dead load of the rake and the pressure applied when cleaning. Vertical steel bars can be used to support conventional rake wheels and eliminate deflection of the plastic bars. Horizontal steel support beams can span the intake openings to minimize deflection of the plastic bars.

Conventional Trash Rake Design for Replacement Trash Racks

Siemens was contacted to discuss modifications to the existing trash rake for cleaning the replacement trash racks. Telephone notes and emails communications are provided in Attachment 4. Siemens does

not recommend use of a conventional, non-guided trash rake, either modification of the existing rake or new rake, with a bar spacing of less than 2 in. Siemens does not have any installations with non-guided traversing rakes on non-metallic racks.

To accommodate a conventional rake, the replacement racks would have to have steel bars to guide the rake wheels. The replacement trash panels would have to steel bars spaced at approximately 9 ft – 9 in. to accommodate the existing rake assembly. The additional weight of the rack panels resulting from these vertical steel bars may required a new hoisting supporting system rather than use of the existing roof beam.

The existing rake teeth would also have to be modified to incorporate a scraper system to allow cleaning of both the 1 in. and 2 in. spaced bars. The ability of this scraper system with cleaning heavy debris in the ascending direction with a conventional rake is not known.

Alternative Trash Rakes for Replacement Trash Racks

Siemens recommends an Automatic Grab Rake System to clean the replacement trash racks. The grab rake cleans a trash racks in the descending motion. Siemens believes this rake could be equipped with a scrapper to allow use with any bar rack spacing. Product data provided by Siemens for the grab rake is provided in Attachment 5. The installed cost of a Siemens' grab rake at Main Street Dam would be $225,000 to $250,000.

Atlas Polar has submitted a quotation (Attachment 6) to Pawtucket Hydropower LLC for a telescoping arm trash rake. Product data from Atlas Polar's web site www.atlaspolar.com is provided in Attachment 7. The installed cost for the Atlas Polar rake would be about $180,000 including $154,000 for the rake installation and $26,000 for cranes, handrails removal, and electrical installation.

Conclusions

The existing conventional traversing trash rake is not well suited for cleaning of the replacement trash racks. Significant modifications to the raking assembly would be required to clean the plastic replacement trash racks. The ability of the modified conventional rake to clean the racks would not be known until actually operated in heavy debris conditions.

Other types of trash rakes, including the Siemens Grab Rake and the Atlas Polar telescoping boom Hydrorake are available and should be considered for cleaning the replacement trash racks.

TC/eh

ATTACHMENT 1

12 MARCH 2009
TRASH RAKE INSPECTION

EA Engineering, Science, and Technology, Inc.

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2350 Post Road
Warwick, Rhode Island 02886
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www.eaest.com

Existing Trash Rake Inspection/Forebay Sediment Sampling
Main Street Dam Downstream Fish Passage Replacement Trash Racks
Meeting Held at Pawtucket Hydropower Plant
Blackstone River Fish Passage Restoration Project
NRCS Contract AG-1535-C-06-01, Task Order AG-1535-D-09-0002
Inspection Notes
12 March 2009 10:00 AM

Present: Charlie Rosenfield [CR], Pawtucket Hydropower
Meghan Walter [MW], NRCS
Andy Lipsky [AL], NRCS
Matt Richardson [MR], EA
Lee Becker [LB], EA
Tom Cook [TC], EA

Other distribution: Sam Whitin [SW], EA
Curt Mason [CM), EA

Purpose: The purpose of the meeting was to:

1) Obtain a sample of the sediment in the hydroplant intake. The Rhode Island Department of Environmental Management permit application has to address disposal.

2) Inspect the existing trash rake to assess its condition and determine if it can be used for cleaning the replacement trash racks required for the downstream fish passage bypass system.

Discussion: TC presented a brief overview of the concept that is being proposed to lift, position, clean, and store the replacement trash racks that will be necessary for excluding downstream migrants from the intake and allow them to seek the bypass sluice entrance. At the time of the sampling and inspection, both hydro turbine units were operating.

A summary of the discussions by topic is presented below. Pictures showing the existing trash rake are attached to the end of these notes.

Sediment Sampling

MR obtained 3 samples of the sediment in the forebay adjacent to the trash racks. The samples were taken approximately 5 ft upstream from the operating deck and 5 ft, 12 ft, and 17 ft from the end of the existing trash rack. All three samples were combined into one composite sample for laboratory analysis.

At the time of the sampling, approximately 11:00 AM, the water depth was 8.75 ft below the operating deck level. The depth of sediment below the operating deck was as follows:

Distance for Trash Rack	Depth below Operating Deck
5 ft	22.5 ft
12 ft	20.5 ft
17 ft	17.3 ft

Trash Rake

TC/LB inspected the existing trash rake to determine if the existing rake could be used to clean the replacement trash racks. No damaged or deteriorated components were observed beyond normal wear for this type of equipment. No stress cracks or failed welds were observed in the existing support frame steel. No wear on the rake assembly or support carriage wheels were evident. Some of the rake assembly steel components and steel hoisting cables appeared to have been recently replaced. CR stated that the bearings on the wheels have been replaced.

CR operated the rake. The rake assembly moved down and up the rack without any obvious problems. The rake teeth appeared to engage the rack bars as designed. CR stated that the existing rake mechanically works and is effective in cleaning the existing 2 3/8-in. spaced bars.

TC asked CR if he had the original Envirex Contract Number, O&M manual, maintenance records, or problem reports in his files. Charlie provided the O&M manual for the rake for EA's use. The Contract No. is H 604618. CR does not have any maintenance records or problem reports. TC will return the O&M manual to CR in a couple of weeks.

TC will be contacting Siemens (current owner of the original Envirex Company) to discuss issues with using this conventional rake with 1-in. bar rack panels and plastic racks, potential modifications which may be necessary to retrofit the existing rake for cleaning the replacement racks. TC will be meeting with Hydrothane on 13 March 2009 in Hingham, MA, to obtain input about the existing rake and other types of rakes on plastic racks. AL asked CR if he would like to attend, but CR has another commitment.

CR expressed concern that the existing rake unit (trolley, win., and rake teeth) would not be adequate for cleaning the new 1-in. racks. The current rake does not effectively remove large leaf accumulations on the 2-in. bars, and he does not believe that the existing conventional rake can be modified to effectively clean bars with 1-in. spacing. CR thinks that a telescoping arm rake would be more appropriate, and he will forward a quotation for a new Atlas Polar rake to EA for consideration.

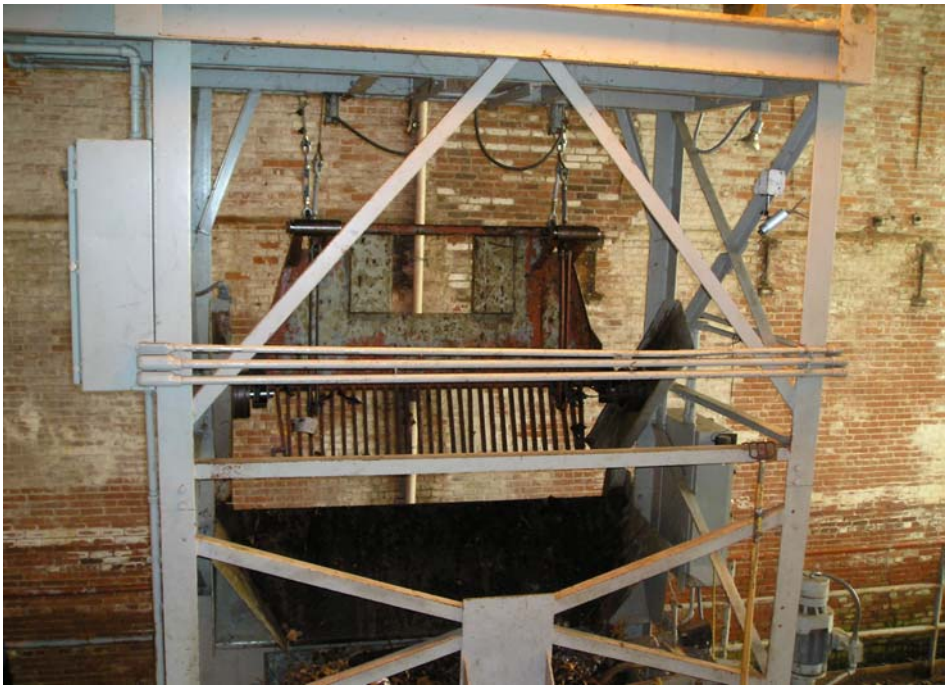
Intake Tunnel Stoplogs Guides

CR stated that last fall he had divers inspect the forebay and intake tunnel. The divers found almost 10 ft of sediment in the forebay adjacent to the existing trash rack. The divers inspected the entire length of tunnel and found the steel guides the stoplogs at the tunnel inlet to be severely deteriorated. The divers believe that these guides could be removed in the "wet" and new beams floated up to the inlet and installed to allow dewatering of the tunnel, forebay, and intake for installation of the replacement trash racks and downstream sluice. TC indicated that another option would be to install a sandbag cofferdam upstream of the Main Street Bridge using a truck-mounted crane operating from the bridge. CR thought that the cofferdam option would not be as cost-effective as the diver and stoplog option.

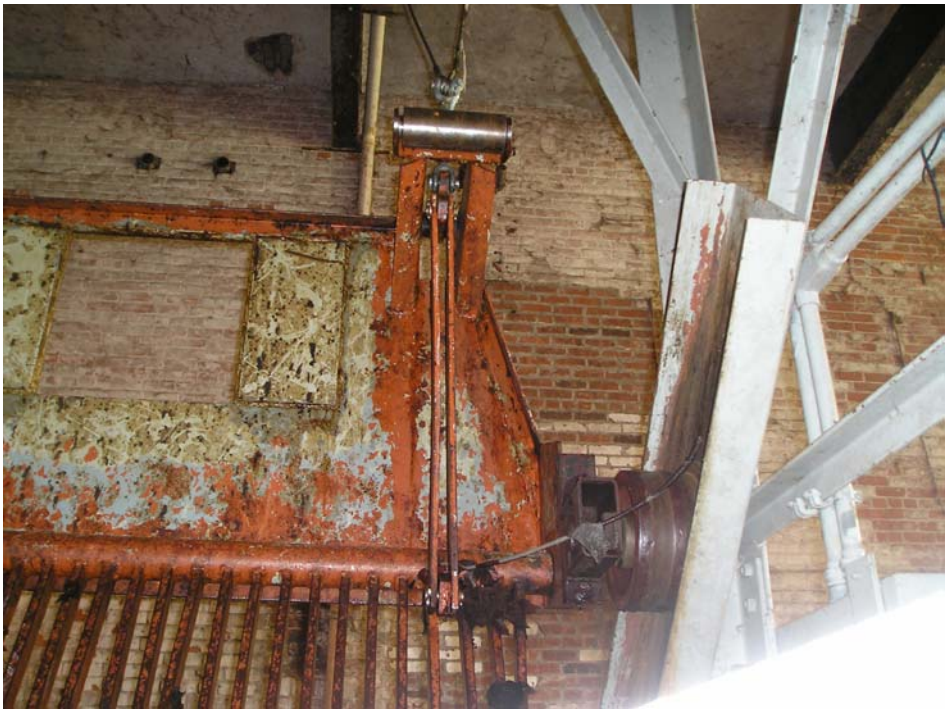
EA Representative: Tom Cook

Signature: Thomas C. Cook
Date: 18 March 2009

Inspection Photographs



Inspection Photographs



Inspection Photographs

ATTACHMENT 2

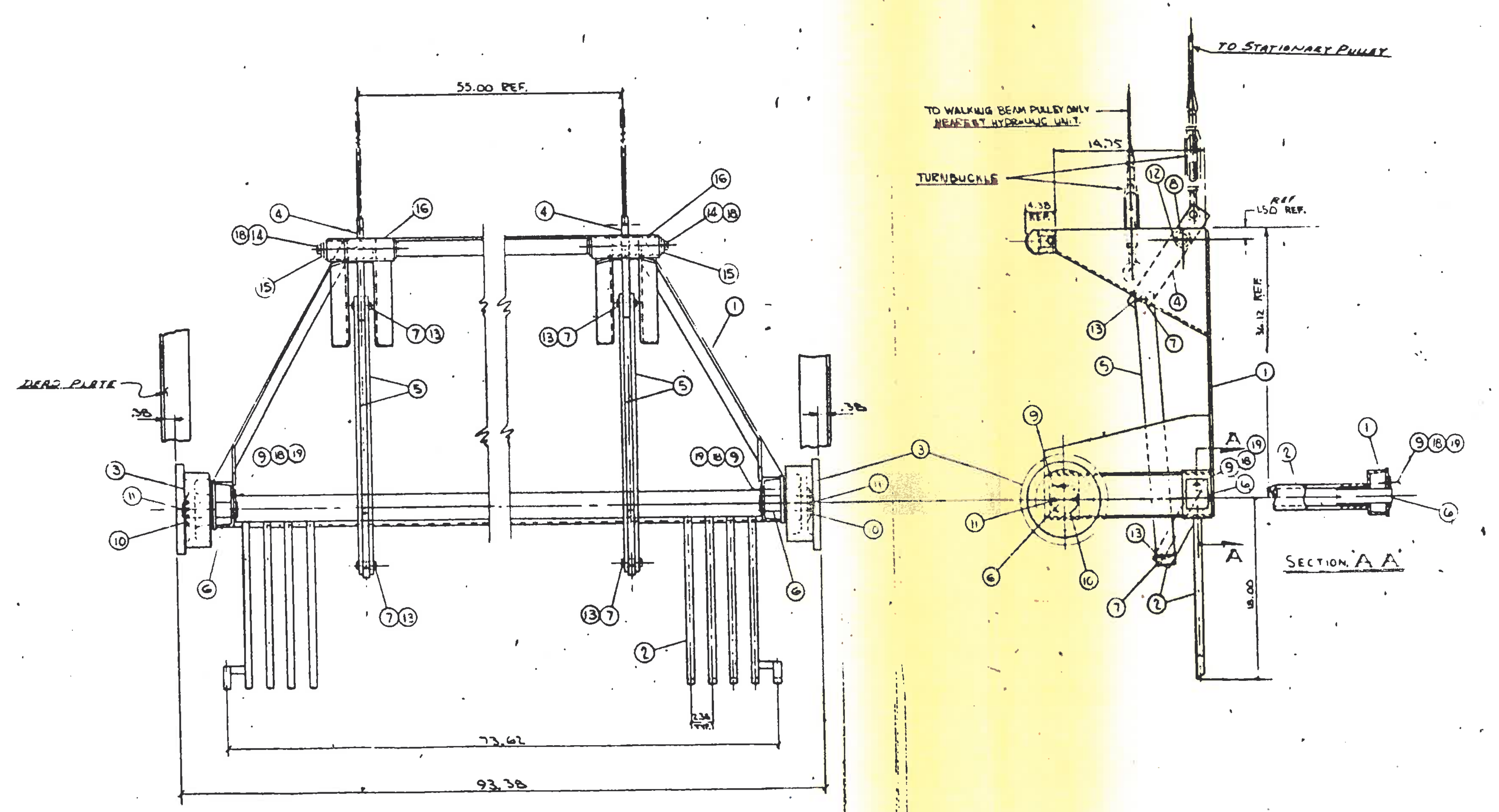
ENVIREX TRASH RAKE DRAWINGS

LIST OF COMPONENTS 4604618-102

ASSEMBLY OF RAKE FRAME WHEELS & ROLLERS · TRASH RAKE

MAT'L REQ'D FOR ONE (1) 100.

1	1	4604618-103-100	FRAME
2	1	4604618-104-100	RAKE TEETH
3	2	[illegible]	WHEEL (CAST SEMI STEEL)
4	2	[illegible] 80	ACTUATOR LINK
5	4	35 40194-2	CONNECTING LINK
6	4	503-40881-81	PIN
7	4	103-80936-1	PIN
8	2	103-80936-2	PIN
9	4	841-19340	1/2 Ø × 1.50 HEX HD. CAP SCREW Z.R.
10	2	841-22520	2 Ø CUT WASHER Z.R.
11	2		1/4 × 2.75 LG. COTTER PIN Z.R.
12	4		1/16 × 2.00 LG. COTTER PIN Z.R.
13	8	841-9170	3/16 × 1.50 LG. COTTER PIN Z.R.
14	4	841-19240	1/2 Ø × .75 HEX HD. CAP SCREW Z.R.
15	2	103-40635-80	PIN
16	2	103-40638-80	ROLLER
17	4	841-20210	1/2 Ø HEX NUT Z.R.
18	8	841-22530	1/2 Ø LOCKWASHER Z.R.
19	2	503-40881-80	PIN

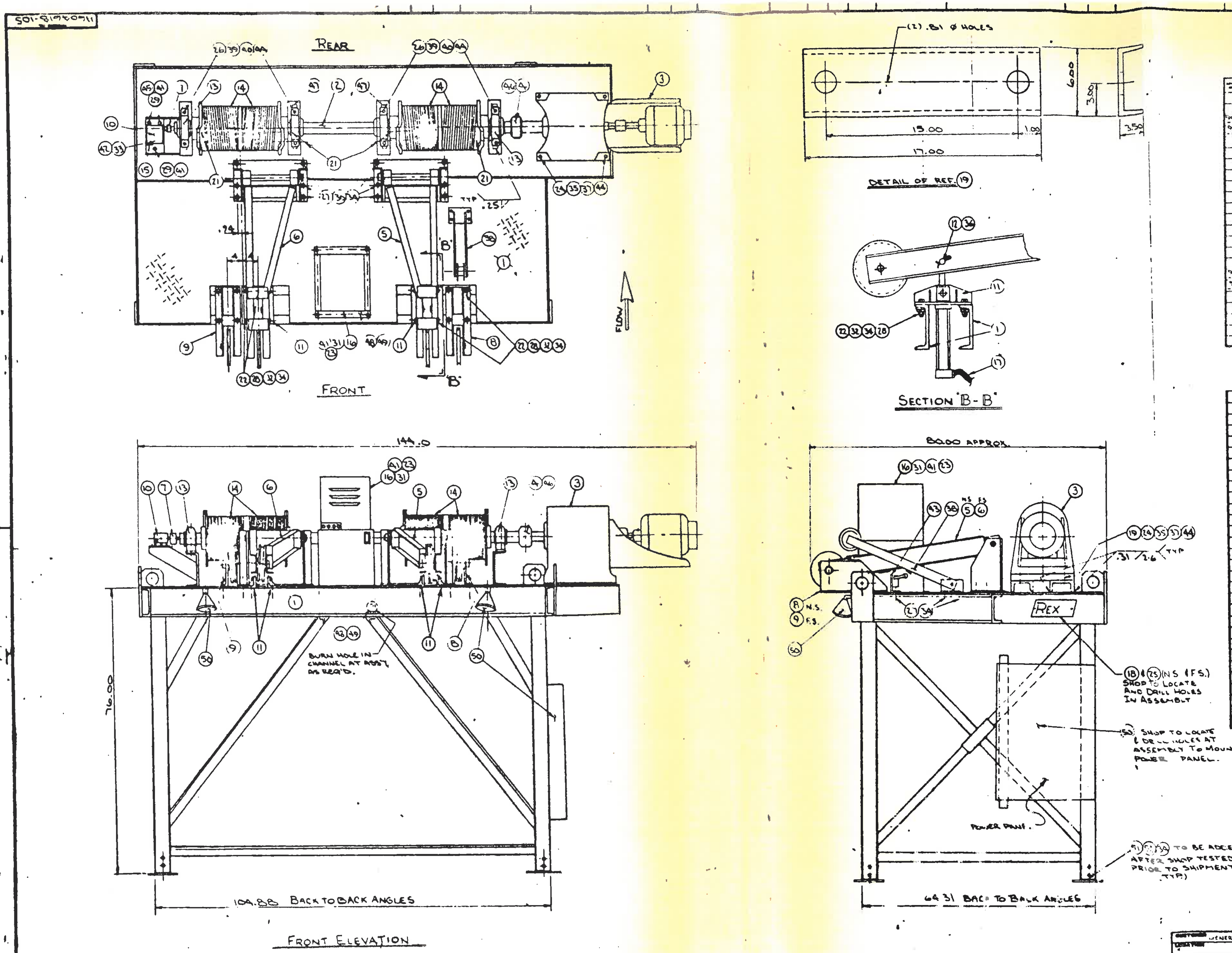


6-23-82	CONFIDENTIAL ALL RIGHTS RESERVED 57153-R2	SEE L/M	3-16-82 CED JUR	NONE

Envirex P.O. Box 1067 Waukesha WI 53187

RAKE ASSEMBLY FOR HEAVY DUTY TRASH RAKE

4604618 — 4604618-102



LIST OF COMPONENTS

5550* H604618-105

"TRASH RAKE UPPER MAIN FRAME ASSEMBLY"

MATERIAL FOR MK 100.

	1	1	H604618-106-100	UPPER MAIN FRAME
	2	1	503-40898-80	HOIST DRIVE SHAFT ASSY
	3	1		HOIST DRIVE UNIT
	4	1	303-60177-89	COUPLING
	5	1	503-30[illegible]-80	WALKING BEAM ASSY. RIGHT HAND
	6	1	503-30[illegible]-81	WALKING BEAM ASSY. LEFT HAND
	7	1	303-6097-80	COUPLING
	8	1	603-2034A-80	STATIONARY SHEAVE SUPPORT ASSY. R.H.
	9	1	603-[illegible]-81	STATIONARY SHEAVE SUPPORT ASSY. L.H.
	10	1	[illegible]-SUB	ROTARY LIMIT SWITCH
	11	4	503-40313-80	HYDRAULIC CYLINDER SUPPORT
	12	2	103-80498-4	PIN
	13	2	8P3-10028-1	BEARING
	14	4	603-20133-15	WIRE ROPE ASSY.
	15	1	103-80766	MOUNTING PLATE
	16	1	303-70074-82	HYDRAULIC POWER UNIT
	17	1	603-20320-83	HYDRAULIC PIPING & FITTINGS
	18	2	103-10209	REX NAME PLATE
	19	2	SEE DETAIL	REDUCER SHIM (C6 [illegible])
	20	2	303-70066	PROCESS EQUIP. PLATE
	21	8	103-81363-1	U-BOLT ASSY
	22	16	103-81272-1	5/8 Ø BEVEL WASHER

H604618-105

	23	1	"SEE SPEC."	PRESSURE SWITCH
	24	4		3/8" Ø x 3 1/2 LG. H.H.C.S. Z.P.
	25	4	841-20080	5/16 Ø HEX NUT Z.P.
	26	8	841-11070	1/4 Ø x 5 LG. H.H.C.S. Z.P.
	27	18	841-09980	5/8 Ø x 1 3/4 LG. HEX HD CAP SCREW Z.P.
	28	16	841-10020	5/8 Ø x 2 LG. HEX HD CAP SCREW Z.P.
	29	3	8P3 10107-01	3/8 Ø THREADED ROD Z.P.
	30	12	841-21990	7/16 Ø CUT WASHER Z.P.
	31	4	841-08770	3/8 x [illegible] H.H.C.S. Z.P.
	32	16	841-22600	5/8 Ø LOCK WASHER Z.P.
	33	3	841-12580	[illegible] Z.P.
	34	42	841 20290	5/8 Ø HEX NUT Z.P.
	35	4	841-20360	3/4 Ø HEX NUT Z.P.
	36	2	841 19170	3/16 Ø x 1 1/2 LG. COTTER PIN Z.P.
	37	4	841-21100	3/4 JAM NUT Z.P.
	38	1	H604618-117-100	SLACK CABLE ARM ASSY
	39	8	841 20360	3/4 HEX NUT Z.P.
	40	8	841-21100	3/4 Ø JAM NUT Z.P.
	41	32	841-20120	3/8 Ø HEX NUT Z.P.
	42	3	841-19970	#10 HEX NUT Z.P.
	43	1	H604618-117-101	SLACK CABLE LIMIT SWITCH ASSY
	44	12	841-22080	3/4 Ø CUT WASHER Z.P.
	45	6	841-11430	3/8 Ø CUT WASHER Z.P.
	46	1	8P3-10018-06	1/4 x 1/4 SQ. KEY
	47	8	8P3-10018-05	3/4 x 3/4 SQ. KEY
	48	1	841 21740	3/4 NUT [illegible]
	49	1		3/4" NPT x 4 LG NIPPLE [illegible]
841	50	1		POWER PANEL W/LIGHTS
	51	4	803-20220-02	SHIPPING PAD
	52	8	841-09940	5/8 Ø x 1 1/2 LG. H.H.C.S. Z.P.

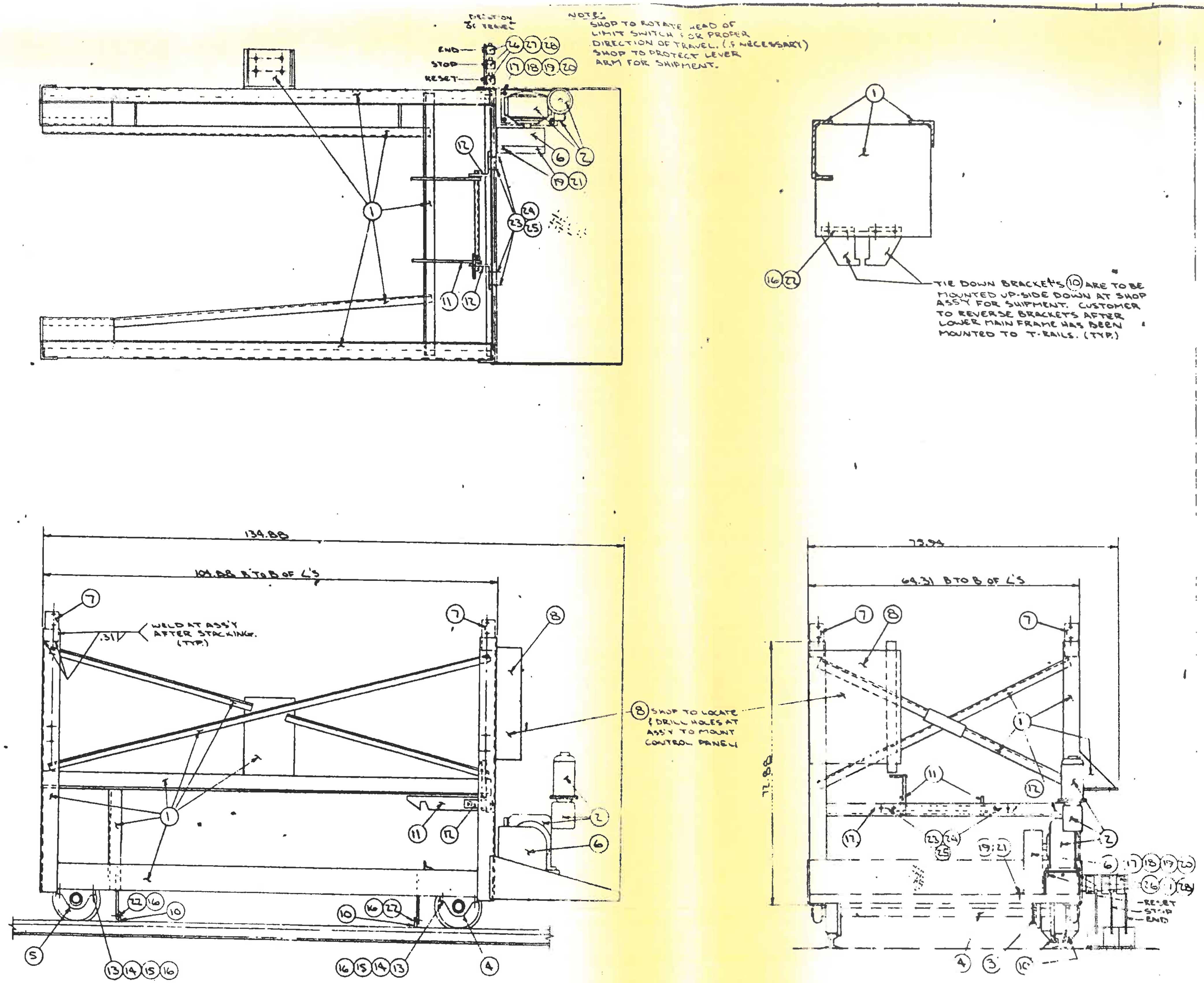
CUSTOMER: GENERAL ELECT. CO / EUA SERVICE

Envirex — Water Quality Control Division — a Rexnord Company

TITLE: TRASH RAKE UPPER MAIN FRAME ASSEMBLY WITH ELECTRICAL CONTROLS MOUNTED ON RIGHT HAND SIDE

ORDER NO. H604618

DRAWING NO. H604618-105



LIST OF COMPONENTS

TRASH RAKE LOWER MAIN FRAME ASSEMBLY

2305# H604618-107

MATERIAL REQ'D FOR ONE MK # 100

Item	Qty	Part No.	Description	
1	1	H604618-108	LOWER MAIN FRAME STRUCTURAL	
2	1	H604618-112	TRAVERSING DRIVE ASS'Y	
3	1	8P3-10150-01	TRAVERSING DRIVE CHAIN	
4	1	803-20035-82	TRAVERSING DRIVE SHAFT ASS'Y	
5	2	803-20034-80	IDLER SHAFT ASS'Y	
6	1	303-40880-81	CHAIN GUARD	
7	4	103-81211	SPLICE PLATE	
8	1		CONTROL PANEL (WITH PUSH BUTTON & LIGHT SWITCH)	
9				
10	4	103-80679	TIE DOWN BRACKET	
11	1	H604618-110	TRAVERSING LATCH ASS'Y	
12	2	H604618-111	MOUNTING ANGLE	
13	12	103-81272-1	5/8" BEVEL WASHER	
14	12	841-10210	5/8" x 3" LG. H.H.C.S.	ZR
15	12	841-22600	5/8" ⌀ LOCKWASHER	ZR
16	20	841-20290	5/8" ⌀ HEX NUT	ZR
17	4	841-09440	1/2" ⌀ x 2" LG. H.H.C.S.	ZR
18	4	841-21920	1/2" ⌀ CUT WASHER	ZR
19	6	841-20210	1/2" ⌀ HEX NUT	ZR
20	4	841-20980	1/2" ⌀ JAM NUT	ZR
21	2	841-09310	1/2 ⌀ x 1 1/4 LG. H.H.C.S.	ZR
22	8	841-10020	5/8 ⌀ x 2 LG. H.H.C.S.	ZR

H604618-107

Item	Qty	Part No.	Description	
23	4	841-08770	3/8" ⌀ x 1 1/2" LG. H.H.C.S.	ZR
24	4	841-21830	3/8" ⌀ CUT WASHER	ZR
25	4	841-20120	3/8" ⌀ HEX NUT	ZR
26	3	SPEC.	LIMIT SWITCH	
27	12	841-12510	#10-24 x 1/2 LG. RHMS	ZR
28	12	841-21710	#10 CUT WASHER	ZR

CUSTOMER: GENERAL ELECT CO./EUA SERV CORP.
LOCATION: MANCHESTER ST. STATION POWER CO.
ENG'R: [illegible]
SCALE: ~
DR: R.R. DUPREE
TITLE: TRASH RAKE, LOWER MAIN FRAME ASSEMBLY.

Envirex · Waukesha WI 53186

ORDER NO.: H604618
DRAWING NO.: H604618-107

CHANGE NOTICE NO.	REV NO.	DATE	DESCRIPTION OF REVISION	REV BY	DATE

ATTACHMENT 3

13 MARCH 2009
NOTES OF MEETING WITH HYDROTHANE SYSTEMS

EA Engineering, Science, and Technology, Inc.

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Hydrothane Systems HDPE (Plastic) Trash Racks
Main Street Dam Downstream Fish Passage Replacement Trash Racks
Meeting Held at Hydrothane Systems Offices, Hingham, MA
Blackstone River Fish Passage Restoration Project
NRCS Contract AG-1535-C-06-01, Task Order AG-1535-D-09-0002
Meeting Notes
13 March 2009 10:00 AM

Present: Matt Brown [MB], Hydrothane
Tom Cook [TC], EA

Other distribution: Charlie Rosenfield [CR], Pawtucket Hydropower, LLC
Meghan Walter [MW], NRCS
Andy Lipsky [AL], NRCS
Lee Becker [LB], EA
Sam Whitin [SW], EA
Curt Mason [CM), EA

Purpose: The purpose of the meeting was to discuss design requirements for installation and cleaning of the replacement trash racks for the Pawtucket Hydropower Project at Main Street Dam on the Blackstone River

Discussion: TC presented a brief overview of the concept that is being proposed to lift, position, clean, and store the replacement trash racks that will be necessary for excluding downstream migrants from the intake and allow them to seek the bypass sluice entrance. A summary of the discussions by topic is presented below.

Replacement Trash Rack Panels

The downstream fish passage system at Main Street Dam for Pawtucket Hydropower Project will have a surface bypass at the existing powerhouse trash racks. A 3 ft wide bypass will be installed through the building stone foundation wall and a sluice installed to convey fish back to the river downstream of the rock ledge on the river bank adjacent to the intake building. The existing trash racks will be replaced with bar racks having 1-in. clear spacing during the downstream migration period and 2-in. clear spacing during the remainder of the year. During juvenile downstream migration, turbine flow would have to be limited to 900 cfs (450 cfs per unit) to maintain a maximum approach velocity of 2 ft/sec at the replacement trash racks.

The replacement trash racks will be fabricated from a plastic material similar to Hydrothanes HDPE racks. The racks will have three (3) panels with bars at 1-in. clear spacing and three (3) panels with bars at 2-in. clear spacing. Each replacement trash rack panel will be approximately 11 ft – 8 in. wide by 28 ft high. The rack material and panel sizes are necessary to limit the size of the hoisting system for installing and removing the rack panels. Because of the limited overhead clearance in the building, the full-depth panels would be stored in the forebay upstream of the abandoned intake openings. A monorail system attached to the existing roof beams will be used to install the panels for the different fish migration periods.

The replacement trash panels will be held in place by vertical steel guides extending from the bottom of the forebay up to the operating deck. The bottom of the panels will be inserted into a bottom channel connected to the existing steel trash rack bottom guide. The top of the panels will have a steel locking device that will extend over the tie rods located between the HDPE bars and bolted to the steel wear plate on the face of the concrete over the intake opening.

The replacement trash rack panels will be lifted using the tie rod/spacers between the HDPE bars. A steel support beam system will be installed on the bottom of the forebay upstream of the operating deck in front of the two existing bays that have been abandoned and have concrete plugs. Replacement trash rack panels that are being stored will sit on the support system and dogged to the operating deck.

Hydrothane Trash Racks

Hydrothane Systems manufacturers a high density polyethylene (HDPE) trash rack for application at hydroelectric projects and other water intakes. The HDPE trash racks are more resistant to corrosion and have a geometry that provides less headloss than steel trash racks. Attachment A provides some of the product data that was downloaded from Hydrothane's web site www.hydrothane.com.

Hydrothane believes that the HDPE trash racks with 1 in. and 2 in. clear spacing can be used for the replacement trash racks at Pawtucket Hydropower Project. Three design issues that have to be addressed are:

- ***Horizontal Supports -*** The replacement trash rack panel have two levels of horizontal supports to minimize deflections. The size and spacing of these supports should be sized to prevent deformation of the HDPE bars with the expected forces resulting from debris accumulation (headloss) and trash raking operations.

- ***Trash Rack Panel Locking System -*** The locking system to be used at the top of the removable trash rack panels has to be designed for the expected forces during raking operations. The locking system should be designed for the rake overload protection forces.

- ***Trash Rack Panel Lifting System -*** The replacement trash rack panels will be lifted using the tie rods between the bars at the top of the panels. MB recommended a two strap lifting system. A spreader lifting bar should be used if the lifting straps do not clear the bars or if more than two lifting points are necessary.

Hydrothane will provide tensile strength, allowable shear stress, and allowable bending stress for the bars and tie rods to EA to complete design.

Trash Rake Options

Hydrothane has installed trash racks at projects with conventional trash rakes and newer telescoping arm trash rakes have been used to clean the HDPE trash racks. Recent projects with Atlas Polar, Inc. telescoping arm rakes are located in Athol, MA, Holyoke, MA, and Proctor, VT (Vermont Marble). Some applications have used a plastic wiper blade without any tooth penetration.

TC requested an installation list and contact information for plants where

- HDPE trash racks with 1 in. and 2 in. clear bar spacing have been installed;
- conventional trash rakes have be used on HDPE racks; and,
- other types of trash rakes, including telescoping arm rakes, have been used on HDPE racks.

MB will assemble available installation list and contact information and email to EA.

The major concern that exists for all types are trash rakes is the pressure exerted on the rack bars by the raking mechanism. The weight of conventional rakes with the wheels riding on the bars can deform the bars if they are not properly supported. A similar concern is the pressure exerted on the bars when the conventional and telescoping arm rake teeth are engaged into the rack. These forces have to be assessed and the support system for the HDPE trash racks properly designed to prevent damage to the trash racks panels.

Action Items

TC and EA will:

- Verify that the horizontal supports are sized and spaced to prevent deformation of the HDPE bars.
- Design trash rack panel locking system for the rake overload protection limit forces.
- Design trash rack panel lifting system to distribute load to tie rods.

MB will:

- Provide installation list and contact information for projects where HDPE trash racks have been installed with 1 in. and 2 in. bar spacing, and where conventional and telescoping arm trash rakes have been used to clean the racks.
- Provide structural design parameters for the HDPE trash racks including tensile strength, allowable shear stress, and allowable bending stress.

EA Representative: Tom Cook

Signature: Thomas C. Cook
Date: 23 March 2009

ATTACHMENT A

HYDROTHANE SYSTEMS PRODUCT DATA

Hydrothane Systems

Navigation

Features
Online Documents
About Us

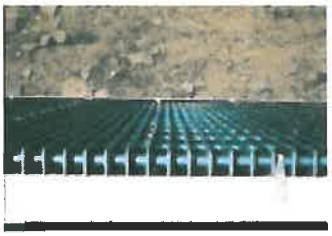
Click links below for more information

General Construction
Flow Characteristics
Frazil Ice & Marine Growth
Load Capacity
Trash Rake Compatibility
Test Reports

Features

- Streamlined blades
- Lightweight (75% lighter than steel)
- High load capacity
- Reduces headloss
- Fish friendly
- Eliminates frazil ice problems
- Resists marine growth
- Eliminates vortex shedding
- Non-corrosive

Unlike typical steel trashracks, Hydrothane will never rust or corrode - even in salt water or other corrosive media.

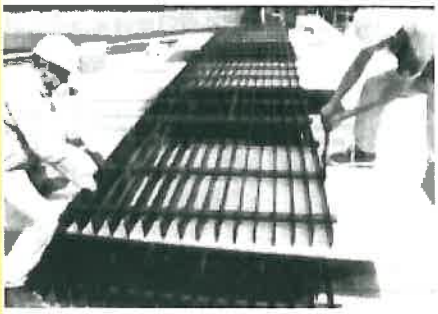


Hydrothane has UV protectors provide longevity in exposed c submerged conditions.

Hydrothane racks shown in a typical low head application in Northern Canada. The old steel racks would freeze solid each winter. This problem was eliminated with Hydrothane.

Features - *General Construction*

Over 300 installations in the USA & Canada



All Hydrothane Trashracks consist of four (4) basic components. Assembly is simple,fast and the low weight of the racks shows up in lower installation costs.

12 new projects in Finland & Sweden in 1999

Vertical Blades:

Composed of high tensile, high load bearing, abrasion resistant virgin polymers (Extra High Molecular Weight Polyethylene) with added releasing agents. Hydrothane's employs a unique profile molding process to assure material consistency and quality throughout.

Horizontal Tie Rods:

Produced from ultra high strength protruded fiberglass rod. Our rods allow the rack to flex with high loads yet return to the original form after the load is released. Rods are 1-1/4" (32 mm) with a smooth un-machined mid section and threaded ends.

Blade Spacers:

Protruded EHMW Polyethylene tubes cut to the customers specifications for blade clearance.

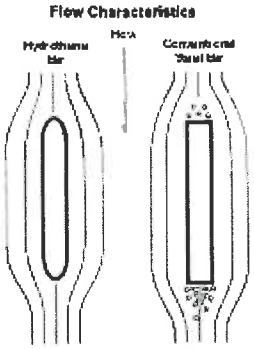
End Nuts:

Injection molded nylon with a tapered internal thread. The end nuts will self-tighten as they are screwed in place. Once in water the end nuts will absorb a small amount of water to expand and lock into place on to the tie rod. No need for additional set pins or other positive means of fixation.

Installation:

As with any water intake installation, adequate horizontal support beams must be present or the racks can be mounted to a frame and slid into place. Hydrothane design engineers will advise you on specifics of support structure. The racks are bolted to the supporting structure using U-Bolts, welded plate or other means of positive fixation.

Features - *Reduced Headloss*



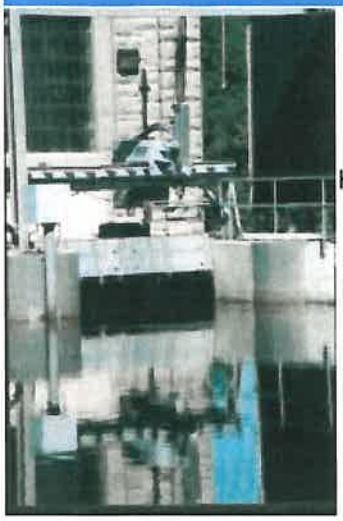
The vertical blades in a Hydrothane Trashrack are styled after U.S. Navy torpedo designs with rounded leading and trailing edges. This proven aerodynamic design reduces resistance to flow in the front and rear of the rack. The smooth blade surface cuts frictional resistance across the blades.

This results in a significant improvement in flow efficiency through the rack itself. Tests and field results have shown the Hydrothane design to cut headloss in half with trashrack bar spacing of 3" (76 mm) or less. This also results in a more fish friendly trashrack.

Visit our Online Documentation to view a pdf file of flow tests conducted on Hydrothane trashracks.

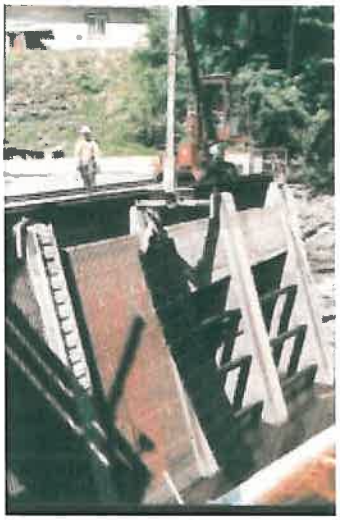
General Construction / Flow Characteristics / Frazil Ice & Marine Growth
Load Capacity / Trash Rake Compatibility / Test Reports

Features - *Trash Rakes*



Hydrothane's abrasion resistant material will stand up to the rigors of automatic trashrack cleaning apparatus when that apparatus has been fitted with a toothed or smooth surface urethane wiper pad. The pad, supplied by Hydrothane, is bolted to the tip of the trash rake.

Hydrothane racks are used with virtually all common trash rakes including: Atlas-Polar, Cross, Duperon Flexrake, HTS, etc.

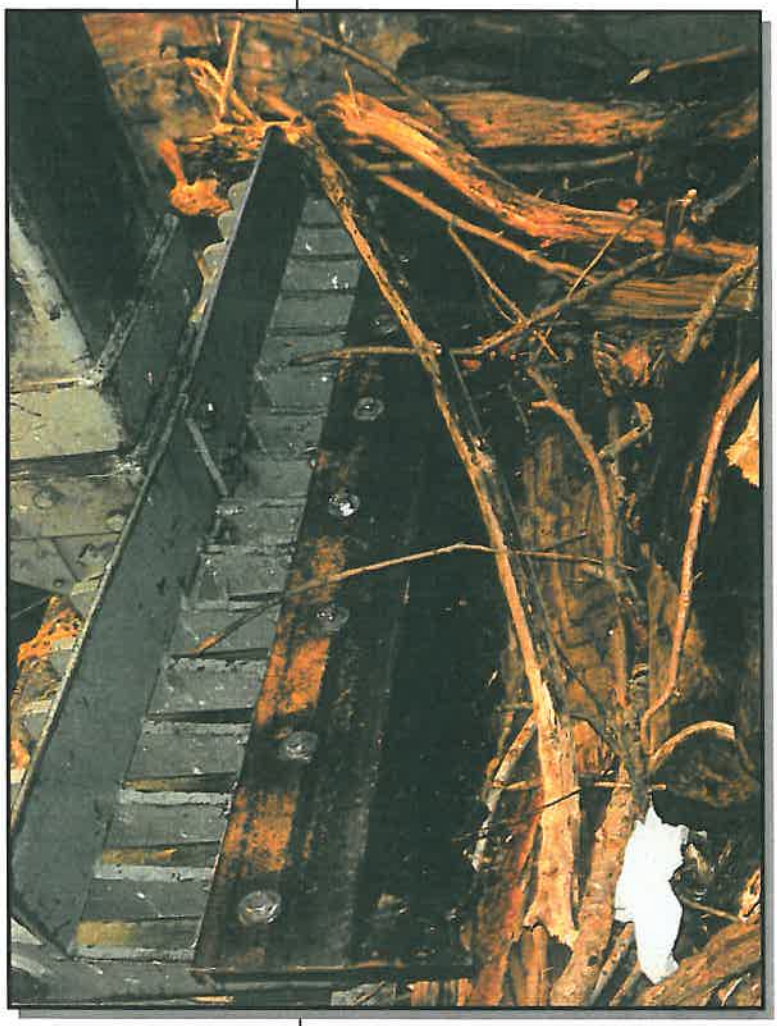


Shown at left is a typical heavy duty Cross type trash rake. Note the urethane pad fitted to the rake tip.

General Construction / Flow Characteristics / Frazil Ice & Marine Growth
Load Capacity / Trash Rake Compatibility / Test Reports

Trash Rakes

Hydrothane Trash Rack bars are constructed from high molecular polyethylene. The trashrack is designed to be used with most conventional trash rake apparatus. As a general rule for both steel and Hydrothane racks, the use of elbow-type rake machines should be avoided if possible. Elbow type machines create excessive impacting on the lower portion of trashracks. The result can be bending of steel racks, fractured weld joints and loosened connection bolts.



For best results Hydrothane recommends the use of a telescoping arm type trash rake such as is produced by Cross Machine (show above) and Atlas-Polar Corp., or HTS Turbine Systems. The telescoping boom allows for greater raking depths while avoiding severe impacting.

Regardless of what raking method is employed, Hydrothane will provide a softer Urethane wiping pad (shown above) to be attached to the end of the trash rake. This pad eliminates unnecessary wear of the blades.

Hydrothane Systems

Hydrothane Systems
1955 Corporate Drive
Pembroke, MA 02359
Tel: 781-829-6777
Fax: 781-829-6935
www.hydrothane.com

FLOW CHARACTERISTICS
OF
HYDROTHANE TRASHRACK ASSEMBLIES

Prepared For

HYDROTHANE SYSTEMS

Prepared By
JOHN C. ROBERGE, P.E.

FLOW CHARACTERISTICS
OF
HYDROTHANE TRASHRACK ASSEMBLIES

JOHN C. ROBERGE, P.E.

INTRODUCTION

The use of coarse bar trashracks on power plant, municipal, industrial and other water intake systems effectively reduces damages to pumps, piping and associated structures and equipment. Steel bar trashracks are extensively employed at such facilities. Vast quantities of empirical data are available to the design engineer for steel bar racks. Idelchik (1966), Handbook of Hydraulic Resistance and D.S. Miller (1968), Internal Flow Systems have evaluated and summarized these data. HYDROTHAEN SYSTEMS has developed a high density polyethylene (DHPE) trashrack bar system which exhibits several potential advantages over steel bar systems. The HDPE racks are highly resistant to corrosion and erosion, but most significantly they demonstrate higher hydraulic efficiency (lower headloss) when compared with typical steel trashracks. The work described in this paper provides the design engineer with basic flow rate – pressure drop data for the HYDROTHANE rack assemblies.

HYDRAULIC PERFORMANCE

The pressure or head drop across a trashrack structure (ΛH) is commonly expressed as a pressure drop coefficient (IK), which is expressed as:

$$IK - \Lambda H/V^2 /2g$$

The pressure drop coefficient is a function of the trashrack Reynolds number and the fractional open area of the rack:

$$IK = f(IR, a_r)$$

The tests described in this summary were all conducted using HDPE extruded bars with a thickness of 0.5in and a section depth of 4.0 in. Each bar edge included a moderate radius, thus relieving the rectangular section of any sharp edges. The HYDROTHANE tests were all conducted in flow ranges which yielded Reynolds numbers typically greater than 1×10^4 . It was thus concluded that the principal and most useful expression for the design of an HDPE trashrack would show IK as independent of IR and provided as a plot of IK versus a_r , where:

a_r = Free Cross Section at Bars/Total Cross Section Area

Velocity, V, was measured as the average velocity of the flow stream approaching the trashracks.

HYDROTHANE RACK ASSEMBLY TESTS

A HYDROTHAEN HDPE trashrack assembly was tested in a 1.5 ft x 3.5 ft hydraulic flume to quantify the headloss through the rack as a function of approach velocity (V) and rack area ratio (a_r). The area ration was adjusted by varying the spacing of the trashrack bars. All of the hydraulic flume tests conducted using 0.5 in x 4.0 in (Nom) HDPE radius edged extruded bars.

Headloss (H) across the trashrack test section (s) was measured as a difference between piezometric head upstream versus downstream of the rack(s). Average approach velocity, V, was determined by measuring the total inflow to the test flume and dividing by the measured area of flow.

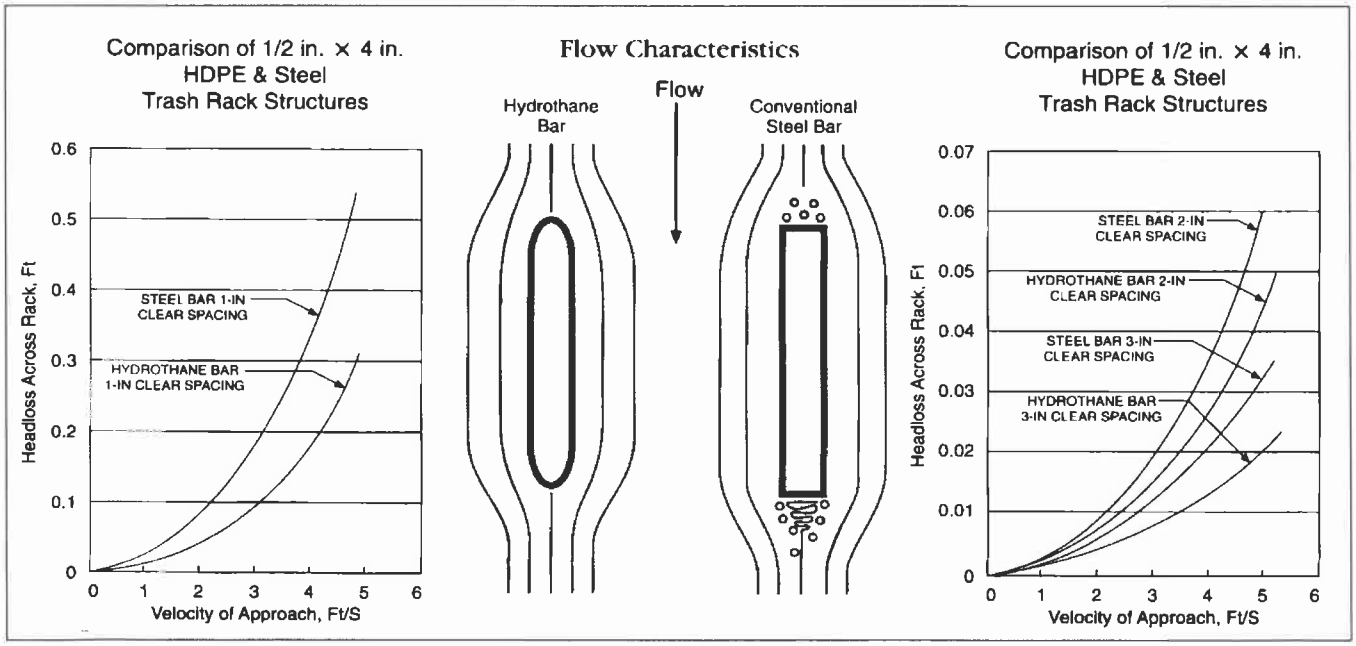
Table 1 is a summary of the test data which was developed for the HYDROTHANE test rack assemblies. These data were averaged for each area ratio, a_r , which was tested. The averaged data points were plotted on the attached plot. This plot included comparison curves for rectangular steel trashrack bars and streamlined steel bar racks.

CONCLUSIONS

The laboratory test results, as summarized on the attached plot, demonstrate that the HYDROTHANE bar rack assembly can provide significantly reduced losses when compared with steel racks of comparable geometry. The potential energy savings were particularly manifested in rack assemblies requiring close bar spacing.

The plot also shows an empirically derived design curve (Miller, 1968) for streamlined steel bar racks. No tests were conducted on streamlined HDPE bars. It could be concluded that streamlining of the HDPE extrusion would result in further decreasing headlosses.

The attached data plot provides design data for engineers and intake structure operators. For any given bar rack geometry (spacing), the anticipated headloss can be determined for the design approach velocity.



HYDROTHANE TEST RACK: HYDRAULIC FLUME TEST											
N	**Flow, cfs**	**h, ft**	**d, ft**	**Total Section Area**	**Free Cross Section**	**Ratio, a/r**	**V, fps**	**K**	**Head Loss, ft**	**H Loss/K**	**Data Average**
5.00	3.040	2.270	3.125	3.393	2.920	0.861	0.896	0.012	0.001	0.080	
5.00	3.600	2.340	3.125	3.498	3.010	0.861	1.029	0.016	0.001	0.061	
5.00	4.250	2.420	3.125	3.617	3.113	0.861	1.175	0.021	0.001	0.047	
5.00	4.710	2.470	3.125	3.692	3.178	0.861	1.276	0.025	0.001	0.040	0.057
7.00	3.120	2.740	2.060	4.096	3.297	0.805	0.762	0.009	0.002	0.222	
7.00	3.190	2.640	2.060	3.946	3.176	0.805	0.808	0.010	0.002	0.197	
7.00	3.510	2.230	2.060	3.333	2.683	0.805	1.053	0.017	0.003	0.174	
7.00	4.130	2.320	2.060	3.468	2.791	0.805	1.191	0.022	0.003	0.036	
7.00	4.510	2.360	2.060	3.528	2.840	0.805	1.278	0.025	0.004	0.158	
7.00	4.850	2.410	2.060	3.602	2.900	0.805	1.346	0.028	0.005	0.178	
7.00	5.440	2.440	2.060	3.647	2.936	0.805	1.492	0.035	0.006	0.174	
7.00	5.130	2.390	2.060	3.573	2.876	0.805	1.436	0.032	0.005	0.156	
7.00	4.990	2.720	2.060	4.066	3.273	0.805	1.227	0.023	0.004	0.171	0.174
10.00	5.560	2.500	1.250	3.737	2.696	0.721	1.488	0.034	0.016	0.465	
10.00	5.880	2.580	1.250	3.857	2.782	0.721	1.525	0.036	0.018	0.499	
10.00	5.440	2.540	1.250	3.797	2.739	0.721	1.433	0.032	0.012	0.376	
10.00	5.220	2.510	1.250	3.752	2.706	0.721	1.391	0.030	0.013	0.433	
10.00	4.290	2.350	1.250	3.513	2.534	0.721	1.221	0.023	0.011	0.475	
10.00	3.820	2.290	1.250	3.423	2.469	0.721	2.116	0.019	0.010	0.517	
10.00	3.460	2.240	1.250	3.348	2.415	0.721	1.033	0.017	0.009	0.543	
10.00	3.460	2.370	1.250	3.543	2.555	0.721	0.977	0.015	0.009	0.608	
10.00	3.330	2.500	1.250	3.737	2.696	0.721	0.891	0.012	0.007	0.568	
10.00	3.180	2.580	1.250	3.857	2.782	0.721	0.825	0.011	0.006	0.568	
10.00	3.120	2.740	1.250	4.096	2.954	0.721	0.762	0.009	0.005	0.555	0.510

NOTE:
(1) All tests were conducted using HYDROTHANE 0.5 IN X 4.0 IN Extruded HDPE radius edge bars
(2) N = No of bars on test rack assembly, flume width = 1.5 FT
(3) Total Cross Section and Free Cross Section Measured in (sqft)

ATTACHMENT 4

COMMUNICATIONS RECORDS

EA Engineering, Science, and Technology

Project No.: 62130.18

COMMUNICATIONS RECORD FORM

Distribution:	(x)	File	( )	
	( )		( )	
	(x)	Author: Tom Cook	( )	

Person Contacted:	Henry Petrovs	Date:	18 March 2009
Title:	Technical Sales Manager		
Affiliation:	Siemens Water Technologies Corporation		
Address:	1901 South Prairie Avenue		
	Waukesha, WI 53187-1604		
Type of Contact:	Telephone (630)841-7944		
Person Making Contact:	Tom Cook		

Communications Summary:

Pawtucket Hydropower Project – Existing Conventional Trash Rake

Siemens has all of the original Envirex drawings and files, but will need a few days to retrieve files from Corporate offices.

Siemens now recommends guided rakes for applications with plastic trash racks because of the weight of the raking assembly.

Thomas C Cook

Signature

EA 0079 3/12/79

DP/C 048

EA Engineering, Science, and Technology

Project No.: 62130.18

COMMUNICATIONS RECORD FORM

Distribution:	(x)	File	( )	
	( )		( )	
	(x)	Author: Tom Cook	( )	

Person Contacted:	Henry Petrovs	Date:	23 March 2009
Title:	Technical Sales Manager		
Affiliation:	Siemens Water Technologies Corporation		
Address:	1901 South Prairie Avenue		
	Waukesha, WI 53187-1604		
Type of Contact:	Telephone (630)841-7944		
Person Making Contact:	Tom Cook		

Communications Summary:

Pawtucket Hydropower Project – Existing Conventional Trash Rake Modifications

Siemens does not recommend use of the existing conventional trash rake for 1-in. clear spacing trash racks. Siemens has a grab rake which is more appropriate for narrow space bars. Grab racks clean on the down stroke rather than the up stroke for conventional rakes. Siemens heavy duty grab rakes come in 4 ft and 6 ft widths.

Henry will send product data for the Siemens grab rake.

Estimated cost for a grab rack is $225,000-$250,000.

Thomas C Cook

Signature

EA 0079 3/12/79

DP/C 048

Cook, Tom

From: Petrovs, Henry (WT) [henry.petrovs@siemens.com]
Sent: Monday, March 23, 2009 10:03 AM
To: Cook, Tom
Subject: Siemens Applications Comments for Contract Trash Rake H604618

Tom,

Applications does not support this application, sorry.

Henry

Henry Petrovs
Technical Sales Manager
Midwest & Eastern Region
Engineered Products & Systems
Intake Products - Rex(r), Link-Belt(r) & Royce(r) Traveling Water Screens Siemens Water Technologies Corp.
1901 South Prairie Avenue
Waukesha, WI 53187-1604
Mobile: (630) 841-7944
E-MAIL: Henry.Petrovs@siemens.com
www.water.siemens.com

> _____
>
> Sent: Monday, March 23, 2009 8:23 AM
> To: Petrovs, Henry (WT)
> Subject: RE: Comments for Contract Trash Rake H604618
>
> Henry,
>
> 1. The typical openings for these Trash Rakes range from 2" to 4".
> 1" is considered a narrow opening for a conventional Non-Guided
> Traversing Trash Rake and usually not recommended. Two (2) Rake
> Assemblies would be needed for two (2) different bar rack clear
> openings.
>
> 2. Is there a problem with the cleaning? Has the Plant considered
> upgrading to an Automatic Grab Rake System?
>
> 3. We do not have any installations of conventional Non-Guided
> Traversing Trash Rakes with Non-Metallic Bar Racks. We have one
> installation of Two (2) Guided Stationary Trash Rakes with
> Non-Metallic Bar Racks.
>
> 4. We do not have any installations of conventional Non-Guided
> Traversing Trash Rakes with 1" Clear Openings.
>
> 5. No installations available.
>

> 6. No, we do not have any information on conventional Traversing Trash
> Rakes operating with Non-Metallic Bar Racks or 1" Clear Openings Bar
> Racks.
>
> Tom
> Sales Support Manager, Intake Products
>
> Confidentiality Note: This e-mail message and any attachments to it
> are intended only for the named recipients and may contain
> confidential information. If you are not one of the intended
> recipients, please do not duplicate or forward this e-mail message and
> immediately delete it from your computer.
>
> -----Original Message-----
> From: Petrovs, Henry (WT)
> Sent: Thursday, March 12, 2009 5:57 PM
> Subject: Comments for Contract Trash Rake H604618
>
> Tom,
>
> Take a look and lets talk.
>
> Henry
>
> -----Original Message-----
> From: Cook, Tom [mailto:tcook@eaest.com]
> Sent: Thursday, March 12, 2009 4:09 PM
> To: Petrovs, Henry (WT)
> Cc: Walter, Meghan - Warwick, RI
> Subject: RE: Drawing for Trash Rake H604618
>
> Henry:
>
> Attached are photographs I took today and scanned copies of the 11 x
> 17 drawing is the O&M manual.
>
> The Envirex rake is Order NO. H 604618 originally installed for
> Blackstone Power Co., Pawtucket, RI. The date of the service manual
> is July 15, 1982.
>
> According to the plant operator, the rake is functional with the
> current 2 3/8 inch trash rack bar spacing. The bars are 3/8 inch
> thick.
>
> As we discussed this afternoon, we need to replace the bars with 1
> inch clear spacing. In fact there will be two sets of bar rack panels
> that will be interchangeable depending on the time of year. During
> downstream migration, the 1 inch clear bars would be installed and
> during the remainder of the year, the 2 inch clear spacing bars would
> be installed. Because the panels will have to be changed 2-4 times
> each year, we would like to use plastic racks to limit the weight.
>
> My questions for you are:
>
> 1) Can the existing rake unit be modified with a rake assembly that
> can clean a 1 or two inch clear bar rack spacing? Will two rake
> assemblies, one for each bar spacing be necessary?

>
> 2) Are there any other components that you think need to be upgraded
> to provide effective cleaning?
>
> 3) Do you have a list of plants where this type of conventional rake
> has been used for plastic racks?
>
> 4) Do you have a list of plants where this type of conventional rake
> has been used on 1 inch clear racks?
>
> 5) Do you have contacts you can provide us for the plants on the item
> 3) and 4) lists?
>
> 6) Do you have any experience records, test results, or plant problem
> reports that you can provide relative to conventional rakes operating
> with plastic racks or 1 inch bar spacing panels?
>
> 7) If a rake assembly replacement is possible for this rake, will you
> provide a budgetary quotation?
>
> If you need more information from the service manual, or have any
> questions, do not hesitate to contact me.
>
> Thanks for your assistance.
>
> Tom Cook, PE
> Senior Engineer/Client Manager
> EA Engineering, Science, and Technology 2350 Post Road Warwick, RI
> 02886
> Phone: (401)736-3440 ext. 221
> Fax: (401)736-3423
> tcook@eaest.com
>

Cook, Tom

From: Petrovs, Henry (WT) [henry.petrovs@siemens.com]
Sent: Monday, March 23, 2009 1:51 PM
To: Cook, Tom
Subject: Siemens Grab Rake
Attachments: Petrovs - Grab.pdf; 1-1-spec heavy duty.doc; 1-6-data sheet heavy duty.doc; 1-1-spec standard duty.2008.doc; 30726-E01-LAYOUT-1.tif; Grab Rake 5.jpg; DSC01249.JPG; PICT0819.JPG

<<Petrovs - Grab.pdf>> <<1-1-spec heavy duty.doc>> <<1-6-data sheet heavy duty.doc>> <<1-1-spec standard duty.2008.doc>> <<30726-E01-LAYOUT-1.tif>> <<Grab Rake 5.jpg>> <<DSC01249.JPG>> <<PICT0819.JPG>> Henry

Henry Petrovs
Technical Sales Manager
Midwest & Eastern Region
Engineered Products & Systems
Intake Products - Rex(r), Link-Belt(r) & Royce(r) Traveling Water Screens Siemens Water Technologies Corp.
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Mobile: (630) 841-7944
E-MAIL: Henry.Petrovs@siemens.com
www.water.siemens.com

EA Engineering, Science, and Technology

Project No.: 62130.18

COMMUNICATIONS RECORD FORM

Distribution:	(x)	File	( )	
	( )		( )	
	(x)	Author: Tom Cook	( )	

Person Contacted:	Bill Dimopoulos	Date:	23 March 2009
Title:	Manager		
Affiliation:	Atlas Polar Company Ltd.		
Address:	60 Northline Road		
	Toronto, Ontario M4B 3E5 Canada		
Type of Contact:	Telephone (416)751-7744 ext. 356		
Person Making Contact:	Tom Cook		

Communications Summary:

Pawtucket Hydropower Project – Atlas Polar Trash Rake Quote Reference 2827

The Atlas Polar telescoping arm rake has been used on plastic trash racks. Bill has worked with Matt Brown (Hydrothane) on projects with trash rack replacements.

Typical installations are with 2 in. bar spacing, but Atlas Polar has supplied the rack for smaller coarse racks and even fish screens. One of their clients is Carolina Power & Light where a rake is being provided for cleaning a nuclear power intake designed to exclude fish. Bill will have Gary Mackey (Atlas Polar Division Manager) provide an installation list and contact references for projects that have been used on plastic racks and bar spacing less than the typical 2 in. opening..

Atlas Polar will be installing one of these telescoping arm rakes to Putnam Hydro (Charlie Rosenfield) next week at the Thundermist Project.

The telescoping arm rake utilizes a scrapper to remove debris. Since there are no teeth that penetrate the bars, the rake can be used on any bar spacing. Closer bar spacings just require more frequent operation. The rake mechanism asserts a 200-250 psi pressure on the bars.

The rake has a 1,250 lb load limit. If the weight is higher than the limit, the rake will go back down and try to lift again. The controls have a timer so that if the raking operation is not complete in a specified period the system will shutdown. The time limit is set for each specific project based on the rack configuration.

Atlas Polar's 8 September 2008 quote does not include:

- A crane for off-loading and positioning of the rake components for installation.
- Three phase power supply.
- Cable conduits for the control box to the end of the rake rail.
- Removal of any handrails and operational interferences. Any handrails will have to be moved back from the edge of the operating deck.
- A debris removal cart or conveyor on the operating deck.

Costs for these items have to be added to the Atlas Polar quote to determine the complete installation cost.

More information about the Atlas Polar telescoping rake can be found at www.atlaspolar.com.

Thomas C. Cook

Signature
EA 0079 3/12/79 DP/C 048

ATTACHMENT 5

SIEMENS GRAB RAKE PRODUCT DATA

Water Technologies

Grab Rake

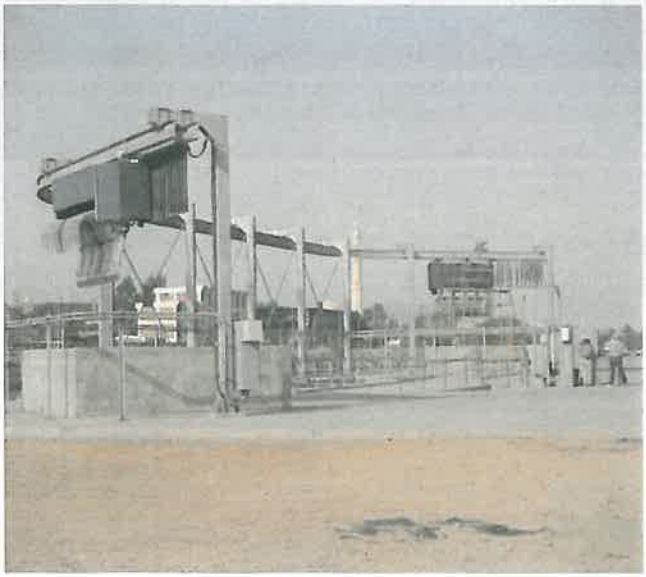
SIEMENS

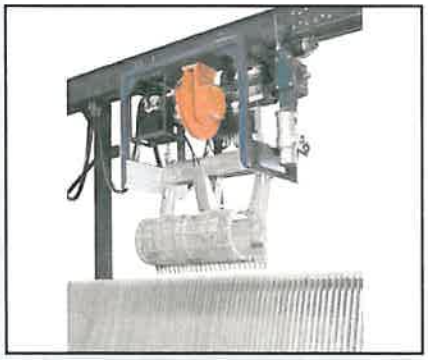
The Grab Rake is a heavy-duty suspended, traversing trash rake that is a significant improvement over conventional trash raking devices. It can automatically clean multiple bar racks or bar screens that are typically used as part of a surface water intake and conveys the trash to a remote disposal location. The rake can handle all types of trash and debris from tree branches and logs, to leaves and grass.

The principle of operation is simple. The rake carriage locates itself over the portion of the bar rack to be cleaned. The rake is lowered, engages the bar rack, and removes trash and debris as it descends to the bottom of the bar screen. At the bottom, the grab closes, capturing the trash and debris. The rake is then raised and the rake carriage travels along the overhead beam to the dumpsite where the grab opens and the trash is discharged.

Siemens Water Technologies recently manufactured and tested Grab Rakes in our Holland, Michigan facility for delivery overseas.

One (1) 4-foot wide Grab Rake was sold to a petrochemical company in Saudi Arabia. The Rake cleans seven (7) bar racks, each 5.25 meters wide by 9.7 meters deep, with 50 mm clear openings. The rake opens to capture debris up to 20 inches wide and has a lifting capacity of 600 pounds.





Two (2) 8-foot wide Grab Rakes were sold for a power station in Egypt. Both rakes are mounted on a single overhead beam set up to clean four (4) bar racks, each 4.625 meters wide by 5.5 meters deep, with 50 mm clear openings. Each rake opens to capture debris up to 36 inches wide and has a lifting capacity of 1100 pounds.

For additional information contact your Intake Products Technical Sales Manager.

Henry Petrovs
262.521.8414,
henry.petrovs@siemens.com

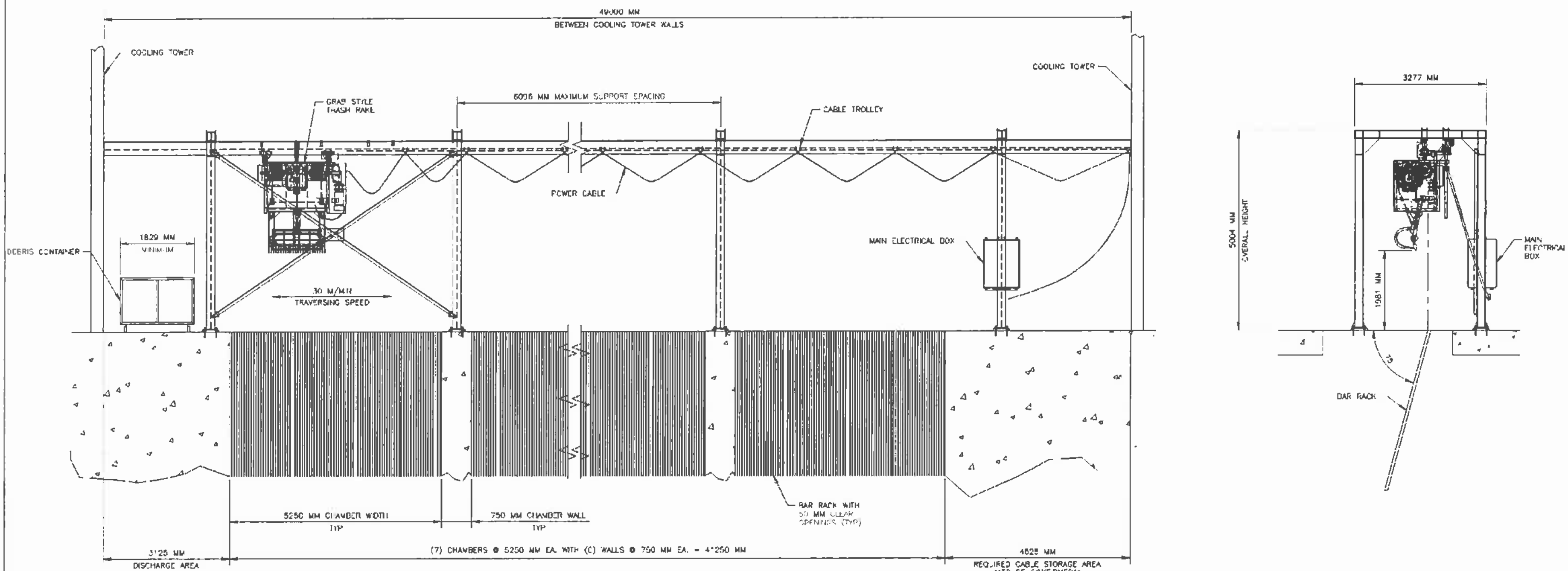
Add ISO statement:
ISO 9001:2000 QMS
The quality **management system governing the manufacture of the Grab Rake is ISO 9001:2000 certified.**

Siemens
Water Technologies
2155 112th Avenue
Holland, MI 49424
www.siemens.com/water

DW-RAKEdr-DS-0707

ENGINEERING STATUS
PRELIMINARY

THIS DRAWING IS FOR PROPOPSAL PURPOSES ONLY
ALL DIMENSION ARE APPROXIMATE AND SUBJECT TO CHANGE



COMPANY CONFIDENTIAL

DESIGNER	DATE
TYSON	01/11/06
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
FILE 30726-E01	
SCALE NONE	

TITLE: GENERAL ARRANGEMENT GRAB STYLE TRASH RAKE

CLIENT

USFilter — ENVIREX PRODUCTS, CHALFONT, PA, TEL: 1-800-207-9490

PROJECT	CODE	DRAWING	SHEET	REV
30726		30726-E01	1 OF 1	C

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN

DIMENSIONS IN INCHES UNLESS SPECIFIED
TOLERANCES UNLESS OTHERWISE SPECIFIED

STD 2 0799 22x34D — MADE FROM: 1081 209 — BAR = 1" AT PLOT SCALE

SIEMENS

Water Technologies

DATA SHEET HEAVY DUTY GRAB RAKE			
PAGES:	**2**	**DOCUMENT NUMBER:**	**1-6-DATA SHEET HEAVY DUTY**

Listed below are the standard features and approved options for the Siemens Water Technologies Heavy Duty Grab Rake. Before proceeding with any deviations from the standard and/or approved options listed below consult with the Product Technical Center.

COMPONENT STANDARDS AND APPROVED OPTIONS

Feature	Standard	Option
Materials		
Rake material	Galvanized	304 or 316 stainless steel
Hoist cable material	304 stainless steel	316 stainless steel
Tooth material	Galvanized	304 or 316 stainless steel
Carriage	Epoxy paint coated	Galvanized
Supports & overhead track	Epoxy paint coated	Galvanized
Fasteners	304 stainless steel	316 stainless steel
Anchor bolts	304 stainless steel epoxy type	316 stainless steel epoxy type
Bar screen material	Epoxy paint coated carbon steel	304 or 316 stainless steel
General		
Rake Width	112"	
Grab Opening	36"	
Debris Lift Capacity	1100 lbs	
Tooth Penetration into bar screen	1.5"	
Volume Capacity	40 ft^3/trip	
Raking Speed (Up/Down)	60 ft/min (at 1800 RPM motor speed)	
Traversing Speed (Left/Right)	100 ft/min (at 1800 RPM motor speed)	
Hoist Motor Size (min.)	10 HP	
Traversing Motor Size (min.)	2 X 0.37 HP	
Hydraulic Motor Size (min.)	2 HP	
Motor Enclosures	TEFC – severe duty	
Support style	"U" shaped	Cantilever – site dependant
Support spacing (max.)	20'-0"	Consult the factory

Feature	Standard	Option
Channel depth (max.)	60'-0"	Consult the factory
Bar screen angle	15°	8° - 20°
Bar screen clear opening	2"	2" – 4"
Curved overhead track min. radius	138" radius	36" radius with special order articulated trolley

Any deviations from the noted standards and/or approved options of the Grab Rake as noted in the Sales and Marketing Manual, Sections 1.1 and 1.6 should be forwarded to the Product Technical Center for review and/or approval. Any revisions or additions to this document are to be submitted to the Product Technical Center for review and approval. Only document revisions that have come from the Product Technical Center are considered to be valid. For contact information on the Product Technical Center, please refer to the Operations and Engineering Manual, Section 2.9.

REVISION	DESCRIPTION	REVISED BY	CHECKED BY	ISSUE DATE
0	Original Issue			

ATTACHMENT 6

ATLAS POLAR QUOTATION

Cook, Tom

From: Charles Rosenfield [putnamhydro@charter.net]
Sent: Tuesday, March 17, 2009 2:37 PM
To: Cook, Tom
Cc: Walter, Meghan - Warwick, RI; Lipsky, Andrew - Warwick, RI
Subject: Fw: pawtucket letter
Attachments: Pawtucket 2827.doc

Tom-
As discussed last week, here is the estimate for an Atlas Polar rake at Pawtucket.

Please let me know if I can supply anything further.
Charlie Rosenfield

----- Original Message -----
From: Gary Mackey
To: 'Charles Rosenfield'
Cc: mfg@atlaspolar.com
Sent: Tuesday, March 17, 2009 1:57 PM
Subject: FW: pawtucket letter

Hi Charles,

Attached is my letter re Pawtucket last year. NOTE: Ceiling height should read 19-2 not 12. Also 2009 estimate to read 154,000.00

Regards,

Gary D. Mackey, Div. Mgr.
Atlas Polar Company Limited
60 Northline Road
Toronto, Ontario M4B 3E5
Tel. (416) 751-7744 Ext 336
Cell (416) 460-4353
[garymackey@atlaspolar.com]

From: Atlas Polar (Manufacturing) [mailto:mfg@atlaspolar.com]
Sent: Monday, September 22, 2008 9:14 AM
To: 'Gary Mackey'
Subject: pawtucket letter

Cathie Taggart
Admin Assistant
Hydrorake & Polar Remote
ATLAS POLAR COMPANY LIMITED
416.751.7744 Ext. 333

Hydrorake Systems Division

September 8, 2008

Putnam Hydro
87 Senexet Rd.
Woodstock, CT
06281

ATTENTION: Charles Rosenfield

Charlie,

Reference: Pawtucket Hydro Trashrake
Atlas Polar Ref. 2827

As promised, the three (3) stage boom was reviewed, laid out and we can rake the racks with a ceiling height of 19'-12". As we discussed the boom material would be larger both for strength and to allow for the internal chain system required. The rail system would utilize a 1/2" wall tube to allow us to span the 33 ft with no center support. There would be one (1) triangular cantilever support (left side) while the right side would sit on the existing wall. Resurfacing may be required for a level landing.

The PLC control panel would be wall mounted requiring a 3" conduit run along the walls to the raking unit. As there is no conveyor a 30 amp breaker (480V) will be sufficient.

The service/access platform would mount off the right hand wall.

SUMMARY OF SUPPLY

- ❒ ST8000 Automatic trashraking system
- ❒ Running rail system w/ upright supports and braces
- ❒ Triangular cantilever supports as required
- ❒ Auto/manual PLC control system
- ❒ Wall mounted control panel
- ❒ Rack extension plate – approx 18"- w/supports
- ❒ Unit service platform as required

- ❒ Complete remote unit status contacts i.e. unit ready, start, stop, running and alarm condition
- ❒ All standard hardware, anchors and control wire (festoon system) to complete installation
- ❒ Delivery to site (nearest trailer access)
- ❒ Installation by an Atlas Polar crew
- ❒ Spare parts kit
- ❒ Three (3) O/M manuals w/ as built drawings
- ❒ Operation and Maintenance school at the completion of the installation

REQUIRED SERVICES BY OTHERS

- ❒ Crane services to off-load and position equipment
- ❒ Three (3) phase power supply w/ breaker wired to the control panel and hook-up
- ❒ All conduits where required
- ❒ Removal of existing handrails and/or any operational interferences.
- ❒ All permits, licenses, bonds or taxes, if applicable

Charlie, an estimate for the above including delivery, installation and rack extension plates (with your usual assistance as listed) is $152,860.00 US.

Also enclosed are copies of the photos I took at Pawtucket and Thunder Mist that might help you in your design or our discussions.

Take care,

Regards,

Gary Mackey
Division Manager

C.c. Bill Dimopoulos, Manager

If you have any questions please call me at 416-751-7744 ext. # 356.

Regards,

Bill Dimopoulos
Manager

C.c. Gary Mackey, Division Manager

ATTACHMENT 7

ATLAS POLAR TELESCOPING BOOM RAKE
PRODUCT DATA

ATLAS POLAR
DELIVERING CUSTOMER SOLUTIONS SINCE 1938

Hydrorake Systems Features & Benefits

Hydrorake System FAQ | Hydrorake System Features & Benefits

Backed by Atlas Polar's engineering experience and over 300 installations across North America, the Atlas Polar Hydrorake has proven reliable and efficient. Installation is relatively simple as production units are engineered for existing and new sites. With two standard models to choose from and specialized units available, the Atlas Polar Hydrorake provides the utmost in flexibility regardless of the application.

Flexible Hydrorake Design
Upstream installation provides clear deck for depositing debris and personnel access

Cantilever supports allow the Hydrorake installation on any width structure. Units require little, if any, reinforcement of the original

deck

There is minimal deck loading with this automatic system

Equipment Maintenance
All moving parts remain above the surface of the water for easy inspection or maintenance

Units come complete with a comprehensive manual that outlines all the essentials, including: system operation, maintenance schedule, troubleshooting guide, and parts lists.

Intake Racks
Effective raking is achieved on various bar spacings and inclines.

Replaceable Scraping Bar on Rakes
The rake head on each unit has a cost-saving replaceable teflon scraping bar.

Modes of Operation
The Atlas Polar Hydrorake is a fully automated system with a built-in manual override. It is capable of continuous operation, timed start operation and remote initiation.

A shallow raking depth is available when the majority of debris is floating. This alternate raking action can increase the speed of operation.

Biodegradable Hydraulic Oil
Hydrorake system uses an environmentally safe oil designed for marine applications.

Hand Held Remote Control
The control panel can be bypassed with the use of a lightweight hand held pendant station.

Fish Screen Facilities
The hydrorake effectively cleans narrow gauge stainless steel screens used in fishery facilities.

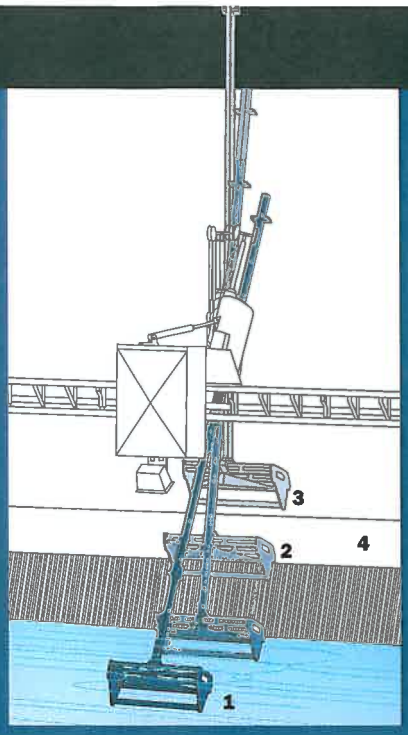
Heaters on all systems
Heaters built into the electrical, hydraulic, and boom systems permit cold weather operation.

Overload Protection
The complete Hydrorake system is protected against electrical and hydraulic overload conditions.

Remote Contacts
Control panel contacts available for remote emergency alarm and status indicators.

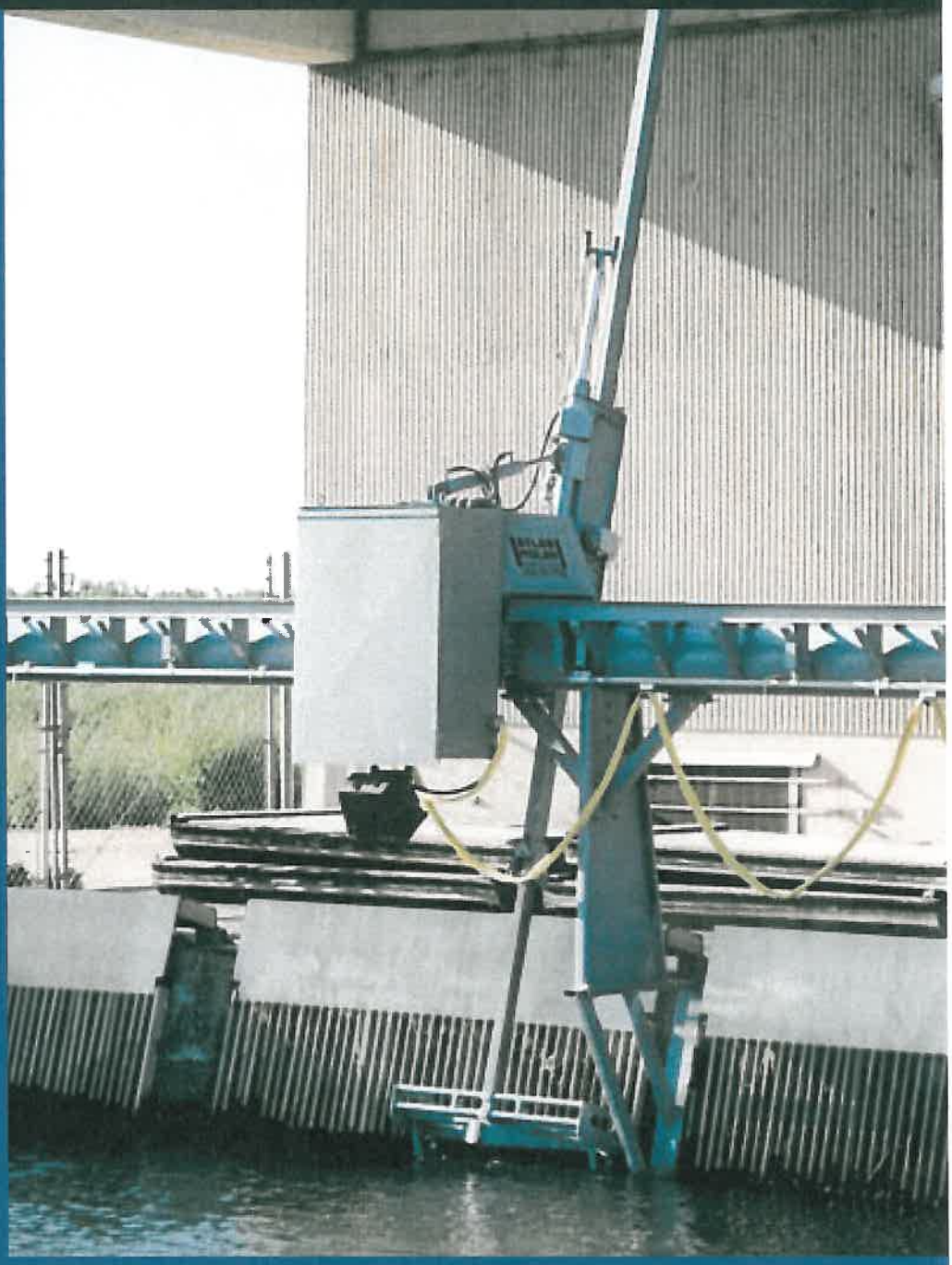
Automatic Transporter Conveyor Systems
The fully integrated transporter spillway automatically moves all raked debris to a suitable dump location at either end of the intake.

Multiple Unit Operation
Allows two or more units to work together to effectively clean racks on sites with extra wide intakes and heavy debris conditions.



How the Atlas Polar ST8000 Hydrorake System works

1. A telescopic boom with rake head extends into the water by means of a hydraulic/ mechanical boom system.
2. A hydraulic cylinder tilts the boom to hold the rake against the racks at a constant pressure while a second cylinder lifts the boom.
3. When the rake reaches the top of the racks it automatically dumps the debris into a spillway that runs the length of the intake.
4. The optional transporter/ spillway system then moves the debris to a collection area on either side of the intake.



The Atlas Polar ST8000 Hydrorake System

Multiple units can be used on the same rail system for intakes with large masses of debris such as the USBR fish screen protection barrier in central Washington state.

Atlas Polar's Hydrorake Division has more than three decades of experience in the field. During that time we have built a reputation as the principal supplier of totally automated trashraking systems to the Hydropower and Water Management industries across North America.

Hydrorake

	Model ST8000	Model DT8300
Lift capacity	1,250 lbs. debris	4,000 lbs. debris
Raking depth	34 ft. below deck elevation	70 ft. below deck elevation
Rake boom design	Single and telescopic staging available	Double and telescopic staging available
PLC control	Auto control panel available with alternate hand-held controller. Control installation available in motor control center or in outdoor weather proof enclosure.	Auto control panel available with alternate hand-held controller. Control installation available in motor control center or in outdoor weather proof enclosure.
Power supply	240/480/575V, 3 phase, 60 HZ	240/480/575V, 3 phase, 60 HZ
Parts	Standard production items, hi-interchangeability of parts	Standard production items, hi-interchangeability of parts
Hydraulic system	2,250 PSI	2,500 PSI
Inward rake pressure	Rake exerts an adjustable 200–300 lbs. pressure on trashracks during upward raking motion	Rake exerts an adjustable 300–500 lbs. pressure on trashracks during upward raking motion
Rakehead width	4 feet/custom	6 feet

Hydrobrush

	Model ST8100
Stainless steel wire orientation	Vertical
Brush/length	Double bristle/5 feet/custom
Brushing depth	40 feet
Screen angle	0° - 30° from vertical
Boom design	Single/double
PLC control	Auto control panel available with alternate hand-held controller. Control installation available in motor control centre or in outdoor weather proof enclosure.
Power supply	240/480/575V, 3 phase, 60 HZ
Side-travel speed	0 - 1.25 ft/sec.
Parts	Standard production items, hi-interchangeability of parts
Hydraulic system	Maximum 2,250 PSI
Inward brush pressure	Variable

Stop Log Lifter

	Model LP2040
Log size	12 or 14 inches wide, up to 29 ft. long
Rail centers	To suit
Sluice depth	30 feet
Boom system	Double telescopic
Power supply	240/480/575V, 3 phase, 60 HZ
Control station	Center console
Boom speed	25 ft./min. average
Side-travel speed	Variable to 50 ft./min.
Breakaway force	10,000 lbs. per boom
Compaction force	20,000 lbs. per boom
Iron style	Hook or spud
Log contact indication	Compactor plate mounted
Hydraulic system	3,000 PSI

Specifications subject to change

ATLAS POLAR

Delivering Customer Solutions Since 1938

Atlas Polar Company Limited 60 Northline Road Toronto ON M4B 3E5

Toll Free: 1 888 799-4422 Local: (416) 751-7740 Fax: (416) 751-2094 E-mail: mfg@atlaspolar.com Web: www.atlaspolar.com