

FISH SCREENING DIRECTIVE

Government of Canada
Department of Fisheries and Oceans

REVISED JANUARY, 1986

WATER INTAKE FISH PROTECTION FACILITIES

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The Department of Fisheries and Oceans has prepared this document as a guide to assist in the design and installation of water intakes and fish screening in British Columbia and the Yukon Territory to avoid conflicts with anadromous fish. Additional precautions must be taken at marine intake locations where entrainment of fish larvae, such as eulachon and herring larvae, is a possibility. The screening criteria constitutes the Department's policy regarding the design and construction requirements pursuant to Section 28 and 55 of the Fisheries Act.

Provisions of the Fisheries Act - Section 28

Every water intake, ditch, channel or canal in Canada constructed or adapted for conducting water from any Canadian fisheries waters for irrigating, manufacturing, power generation, domestic or other purposes, shall, if the Minister deems it necessary in the public interest, be provided at its entrance or intake with a fish guard or a screen, covering or netting, so fixed as to prevent the passage of fish from any Canadian fisheries waters into such water intake, ditch, channel or canal.

The fish guard, screen, covering or netting shall have meshes or holes of such dimensions as the Minister may prescribe, and shall be built and maintained by the owner or occupier of the water intake, ditch, channel or canal subject to the approval of the Minister or such officer as the Minister may appoint to examine it.

The owner or occupier of the water intake, ditch, channel or canal shall maintain the fish guard, screen, covering or netting in a good and efficient state of repair and shall not permit its removal except for renewal or repair, and during the time of such renewal or repair is being effected, the sluice or gate at the intake or entrance of the water intake, ditch, channel or canal shall be closed in order to prevent the passage of fish into the water intake, ditch, channel or canal.

PROCEDURES FOR INSPECTION AND APPROVAL OF INTAKE STRUCTURES

Diversions less than 0.0283 cms (one cubic foot per second): The intake structure shall be constructed in accordance with specifications indicated herein. Upon completion of construction and prior to operation the owner shall contact a local representative of the Department of Fisheries and Oceans to arrange for on-site inspection and approval of the installation. Permanently submerged screens must be inspected prior to installation.

Diversions greater than 0.0283 cms (one cubic foot per second): The owner shall submit to the Department of Fisheries and Oceans 2 sets of detailed plans of the proposed installation for review and approval prior to fabrication. Design drawings are required whenever the diversion quantity exceeds 0.0283 cms (1.0 cfs) or 817,200 L/day (180,000 Igpd) for industrial diversions (calculated on the basis of 8 hours/day) or 123,350 cm³ (100 ac.ft./year) for irrigation diversions (calculated on the basis of 100 days/year and 12 hours/day). The plans shall contain the following information:

1. Intake structure location and dimensions.
2. Maximum discharge capacity of diversion.
3. Screen dimensions.
4. Mesh size.
5. Screen material.
6. Fabrication details.
7. Minimum and maximum water levels at the intake site.
8. Provision for bypassing fish.

The intake structure shall then be constructed in accordance with the approved plans. Upon completion of construction and prior to operation, the owner shall contact the local representative of the Department of Fisheries and Oceans to arrange for on-site inspection and approval of the installation. Permanently submerged screens must be inspected prior to installation.

SPECIFICATIONS FOR INTAKE STRUCTURES WITHOUT PROVISION FOR AUTOMATIC CLEANING

1. Screen Material: The screen material shall be either stainless steel, galvanized steel, aluminum, brass, bronze, or monel metal. Stainless steel is preferred since corrosion is greatly reduced.
2. Screen Mesh Size: Clear openings of the screen (the space between strands) shall not exceed 2.54 mm (0.10 inch). The open screen area shall not be less than 50% of the total screen area. The following square-mesh wire cloth screens are recommended;
 - 7 mesh, 1.025 mm (0.041 inch) wire, 51% open, 2.54 mm (0.10 inch) openings; or
 - 8 mesh, 0.875 mm (0.035 inch) wire, 52% open, 2.25 mm (0.09 inch) openings; or
 - 8 mesh, 0.700 mm (0.028 inch) wire, 60% open, 2.54 mm (0.10 inch) openings.
3. Screen Area: A minimum unobstructed screen area (gross area) of 0.93 square meter (10 square feet) shall be provided for each 0.0283 cms (1 cfs) of water entering the intake. The required screen area shall be installed below minimum water level. Screen area lost by framing shall not be included as part of the unobstructed screen area.

4. Screen Support: The screen shall be adequately supported with stiffeners or back-up material to prevent excessive sagging.
5. Screen Protection: The intake structure shall, where necessary, be equipped with a trash rack or similar device to prevent damage to the screen from floating debris, ice, etc.
6. Screen Accessibility: The screen shall be readily accessible for cleaning and inspection. Screen panels or screen assemblies must be removable for cleaning, inspection and repairs.
7. Allowable Openings: The portion of the intake structure which is submerged at maximum water level shall be designed and assembled such that no openings exceed 2.54 mm (0.10 inch) in width.
8. Design and Location: The design and location of the intake structure shall be such that a uniform flow distribution is maintained through the total screen area.
9. Fish Bypass: The intake shall be designed to provide a transverse velocity (the component of the velocity parallel and adjacent to the screen face) to lead fish to a bypass or past the screens before they become fatigued. In no case should the transverse velocity be less than double the velocity through the screen.

SPECIFICATIONS FOR INTAKE STRUCTURES WITH PROVISIONS FOR AUTOMATIC CLEANING

The specifications are identical to those for intake structures without provisions for automatic cleaning except that the minimum unobstructed screen area (gross area) of 0.23 square meter (2.5 square feet) need only be provided for each 0.0283 cms (1 cfs) of water entering the intake. However, a regular cleaning and maintenance schedule is required to ensure seals and screen panels remain in good repair, preventing impingement and entrainment of fish and debris.

For these self-cleaning intake structures, the location, design and juvenile fish avoidance system all affect operating characteristics. The final design, therefore, may incorporate modifications reflecting the best current technology available for minimizing adverse impact upon the fisheries resource.

ALTERNATE FISH PROTECTION FACILITIES

Enquiries concerning the Department's requirements for indirect intakes, such as infiltration galleries and wells, for salt water ocean intakes, and for new methods or devices for screening intake structures should be directed to the Department of Fisheries and Oceans, Senior Habitat Management Biologist.

ADDRESSES FOR CORRESPONDENCE AND APPROVALS

1. Habitat Management Unit
Fraser River, Northern B.C. and Yukon Division
Department of Fisheries and Oceans
Room 330, 80 6th Street
New Westminster, B.C. V3L 5B3
Phone: 666-6479

2. Habitat Management Unit
South Coast Division
Department of Fisheries and Oceans
3225 Stephenson Point Road
Nanaimo, B.C. V9T 1K3
Phone: 756-7270

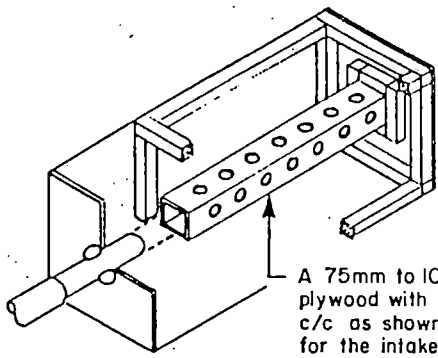
3. Habitat Management Unit
North Coast Division
Department of Fisheries and Oceans
Room 109, 417 - 2nd Avenue West
Prince Rupert, B.C. V6J 1G8
Phone: 624-9385

Other Federal and Provincial agencies having jurisdiction in water withdrawals and construction pertaining to watercourses in British Columbia include:

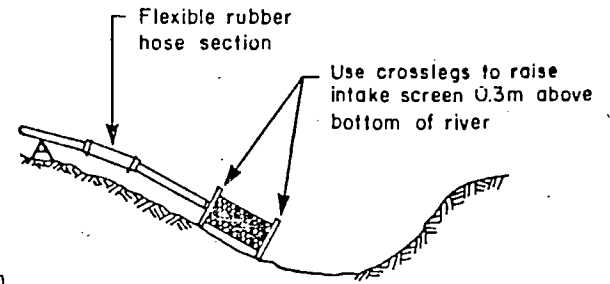
1. Provincial Fish and Wildlife Branch
Ministry of Environment
2. Provincial Water Management Branch
Ministry of Environment
3. Provincial Ministry of Agriculture and Food
- 4.. . Provincial Ministry of Lands, Parks and Housing
5. Canadian Coast Guard
Transport Canada
6. Environment Canada
Canadian Wildlife Service

It may be necessary that several or all these agencies also be solicited for approvals prior to the installation of a water intake.

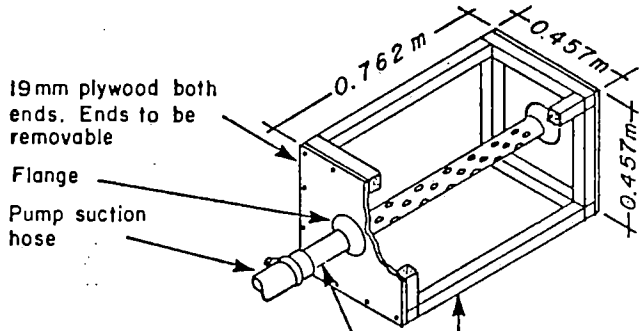
Revised January, 1986



A 75mm to 100mm square box of 19mm plywood with 25mm dia. holes at 75mm c/c as shown, may be substituted for the intake pipe below

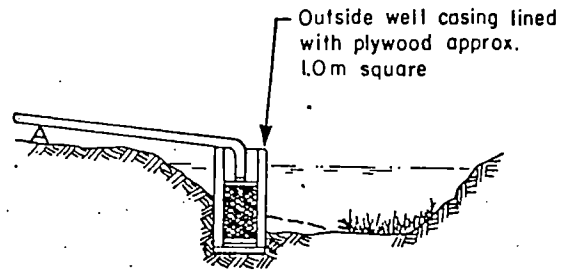


STANDARD INSTALLATION

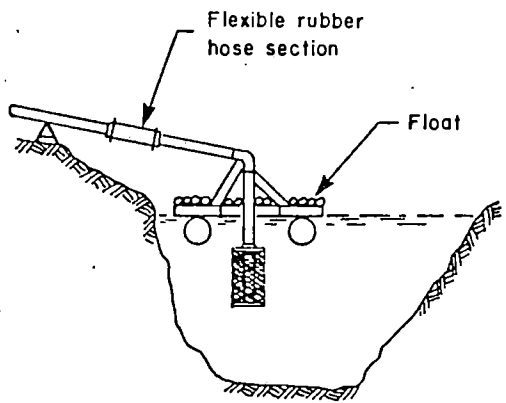
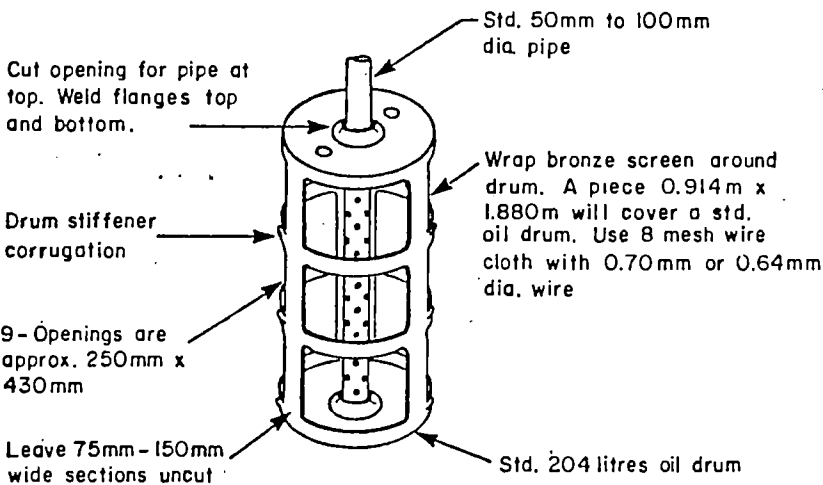


50mm-100mm std. pipe with the section inside the screen box perforated with 16mm dia. holes at 50mm to 100mm c/c staggered

50mm x 50mm painted framing covered on 4 sides with bronze screen (wire cloth) stretched tight and fastened to the framing only. Plywood ends to be removable. Use 8 mesh wire cloth with 0.70mm or 0.64mm dia. wire



INSTALLATION IN SHALLOW WATER
MUDDY OVERGROWN BOTTOM



INSTALLATION IN DEEP WATER

NOTE:

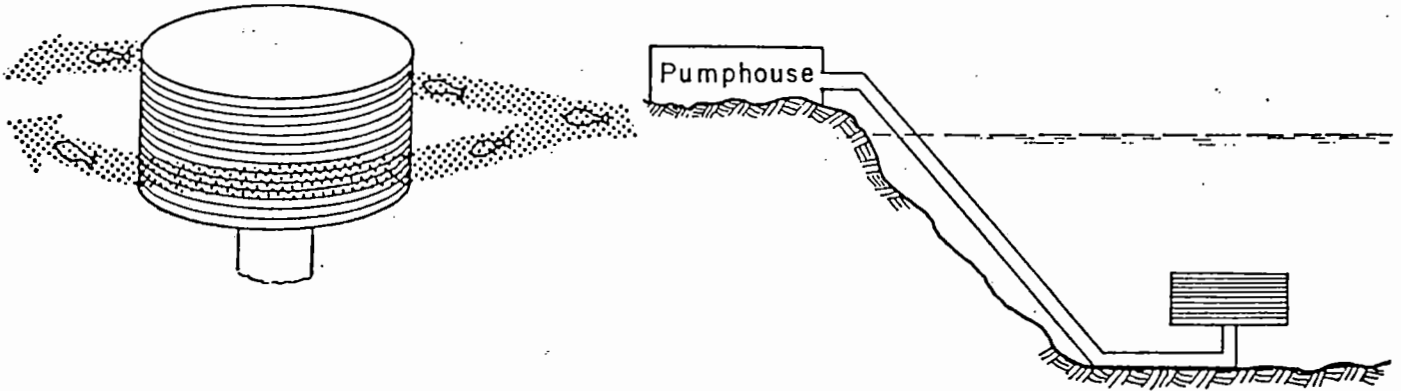
1. Oil drum shall be thoroughly washed out or steam cleaned before cutting openings.
2. All loose rust shall be removed and the drum coated with metal primer. Two coats of machinery enamel or epoxy paint shall be applied before covering with wire cloth.

NOTE:

All screens shall be installed below minimum water level, shall be easily accessible for cleaning, and shall be cleared of debris at regular intervals.

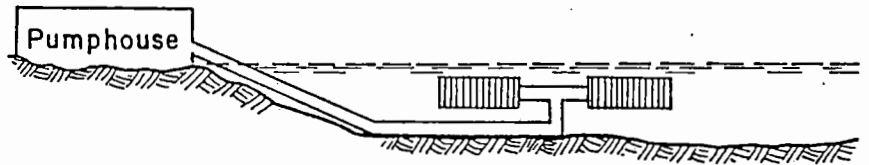
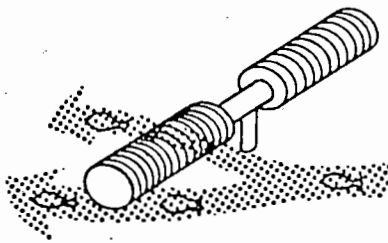
SMALL STATIONARY WATER INTAKE SCREENS

(For pumps of a capacity less than 1c.f.s. [28.3 L/sec., 449 U.S. or 374 Igpm])



DEEP WATER WELL SCREEN

May be installed in lakes and the ocean.



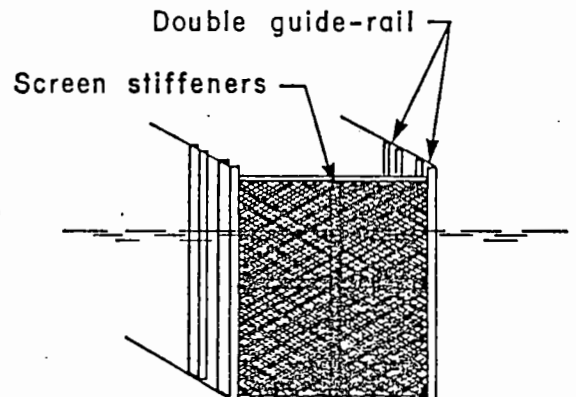
SHALLOW WATER WELL SCREEN

May be installed in lakes, pools, and stable areas in rivers.

Totally submerged cylindrical shaped stainless steel well screens provide for high intake capacity and large percentage of open area permitting water to enter at low velocities. Slot opening shall not exceed 2.54mm (0.10 inch).

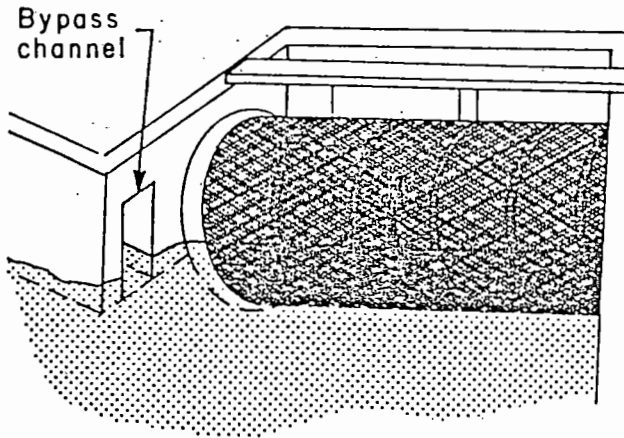
VERTICAL PANEL SCREENS

May be installed in rivers, lakes and the ocean. Generally, requires coarse trashracks, a sluice gate in river installations, double sets of guide-rails, and standby screen panels to allow for cleaning and repairs.



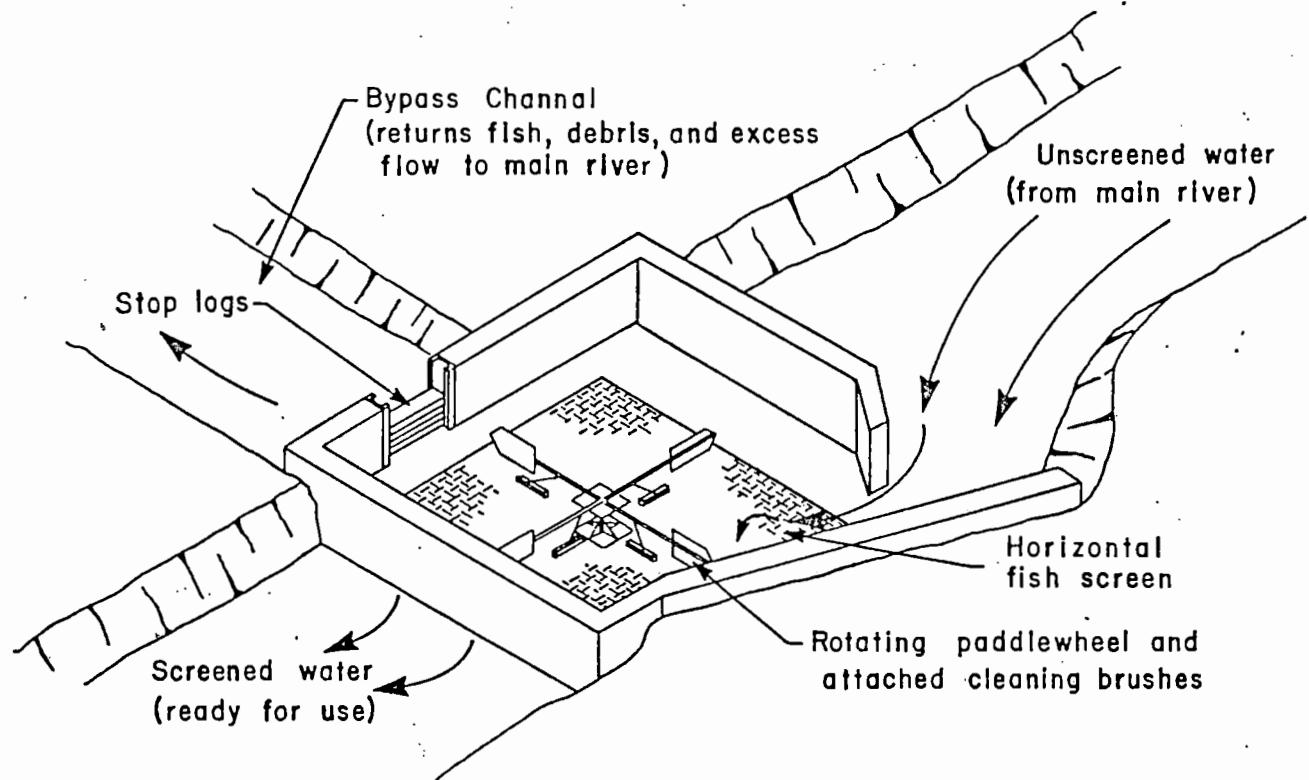
LARGE STATIONARY WATER INTAKE SCREENS

(For pumps of a capacity more than 1c.f.s [28.3 L/sec., 449 U.S. or 374 Igpm])



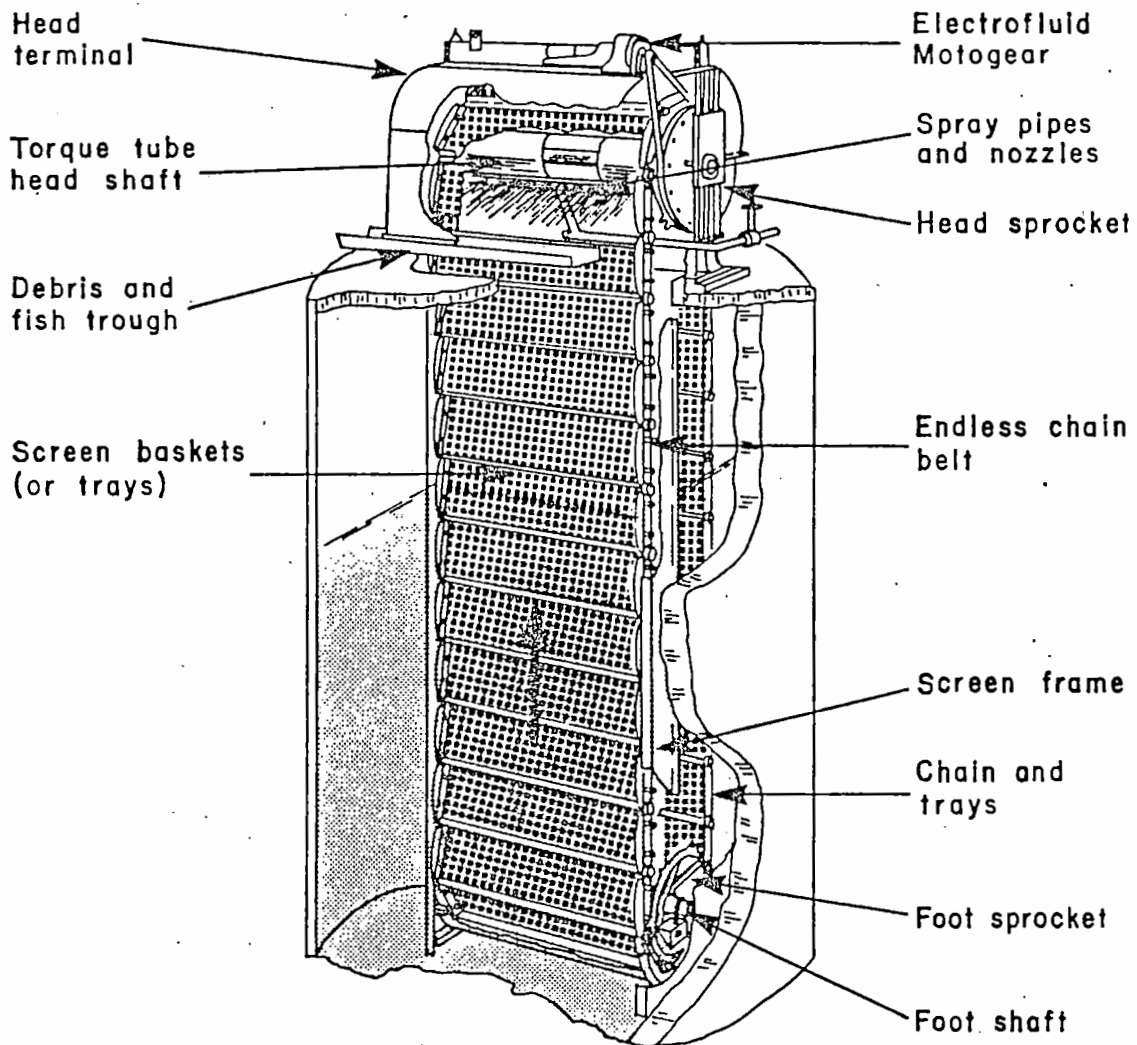
REVOLVING DRUM SCREEN, HORIZONTAL AXIS

Generally, installed to divert fish from irrigation canals. Can be driven by a small motor or by a paddle wheel. To avoid juvenile fish impingement, a bypass channel is required near the front of the screen. Rubber seals are necessary along the base and sides.



FINNIGAN SCREEN

The horizontal, self-cleaning Finnigan Screen is another concept, generally installed to divert fish from irrigation or enhancement projects. The stationary horizontal screen is kept clean by a set of brushes attached to a revolving paddle wheel powered by the water current entering the structure. A portion of the flow, the suspended debris, and fish are directed to the bypass channel. The remainder of the flow passes through and below the screen for use as required.



CONVENTIONAL VERTICAL TRAVELLING SCREEN

May be installed in rivers, lakes and the ocean. A common screening method utilized by industry, these self-cleaning mechanical screens with modifications can prevent impact upon fish. Mounted flush to the stream bank (shoreline) or as pier intakes within streams and provided with an opening on the downstream end between the intake screens and trashracks, juvenile fish can generally escape entrapment. Rubber panel, side, and boot seals are required to prevent juvenile fish from gaining entry into the pumpwell. A safe bypass system is essential to return juvenile fish with debris back to the watercourse. Automatic controls are also necessary to ensure operation at a specific minimum head differential.

LARGE INDUSTRIAL AND DOMESTIC WATER INTAKE SCREEN

CONVERSION FACTORS

1 cubic foot per second (cfs) = 0.0283 cubic metres per second (cms)
= 28.32 litres per second (L/sec.)
= 1.98 acre feet per day (ac. ft./day)
= 374 Imperial gallons per minute (Igpm)
= 449 U.S. gallons per minute (USgpm)

1 cubic metre per second (cms) = 35.32 cfs
= 1000 L/sec
= 69.9 ac. ft./day
= 13,215.5 Igpm
= 15,865.7 USgpm

100 Imperial gallons per minute = 0.268 cfs
100 U.S. gallons per minute = 0.223 cfs
100 litres per minute = 0.059 cfs

1,000,000 Imperial gallons per day = 1.86 cfs
1,000,000 U.S. gallons per day = 1.55 cfs
1,000,000 litres per day = 0.409 cfs

1 metre = 3.281 feet
1 cubic metre = 1.308 cubic yards
1 cubic foot = 0.0283 cubic metres
1 Imperial gallon = 1.20095 U.S. gallons
1 Imperial gallon = 4.545 litres
1 U.S. gallon = 3.785 litres

1 hectare = 10,000 square metres
1 hectare = 2.471 acres
1 acre = 43,560 square feet
1 mile = 1.609 kilometres
1 cubic foot of water weighs 62.43 pounds or 28.32 kilograms
0.10 inch = 3/32 inches (approx.) = 2.54 millimeters