

OVIVO CASTKLEEN™ FILTER UNDERDRAIN (PIER DESIGN) SPECIFICATIONS

Specifications for the OVIVO CastKleen Filter Underdrain supported by piers are presented in the Construction Specification Institute standard format as used by a majority of consulting engineers. Though the format presented here may not exactly match the format used by a specific consulting engineer, it should be close enough that the specifications can be used with minor changes. The OVIVO Water Treatment Products Group will be pleased to prepare specifications specific for a given project if given the information necessary to fill in the specification blanks. Information necessary to fill in these specifications can best be provided by filling in the OVIVO CastKleen™ Filter Underdrain Specification Information Questionnaire. Completed specifications are available either in hard copy or on computer diskette. Note that the word processing software used is WordPerfect®.

These specifications have been drafted assuming that there are multiple filter cells as will be the case under most circumstances. Should the project under current consideration include a single filter cell, minor changes in the language will be required.

There are several pieces of collateral information that can be used in conjunction with these specifications to describe a CastKleen Filter Underdrain. The CastKleen Filter Underdrain brochure gives a general overview of the underdrain employed in the CastKleen Filter in words and pictures. The CastKleen Filter Underdrain Description will give some insight into where CastKleen Filters can best be applied and the parameters for their design. The FlexKleen™ Mark III Nozzles brochure gives specific information about the underdrain nozzle employed. The following EIMCO General Arrangement Drawings give detail to be used in the preparation of Contract Drawings:

- * Drawing 196513 - General Arrangement CastKleen Filter Underdrains Plan View
- * Drawing 196514 - General Arrangement CastKleen Filter Underdrains Illustrative Sections
- * Drawing 196515 - General Arrangement CastKleen Filter Underdrains Support Pier Details
- * Drawing 196516 - General Arrangement CastKleen Filter Underdrains Underdrain Floor Reinforcement Layout
- * Drawing 196517 - General Arrangement CastKleen Filter Underdrains Details

- * Drawing 196518 - General Arrangement CastKleen Filter Underdrains Dimensional Data 2 gpm/sq ft Filter Rate
- * Drawing 196519 - General Arrangement CastKleen Filter Underdrains Dimensional Data 4 gpm/sq ft Filter Rate
- * Drawing 196520 - General Arrangement CastKleen Filter Underdrains Dimensional Data 6 gpm/sq ft Filter Rate
- * Drawing 196521 - General Arrangement CastKleen Filter Underdrains FlexKleen Mark III Nozzle Assembly with Adjustable Tailpipe

Specifications describing ancillary filter equipment which can be supplied as a complement to CastKleen Filter Underdrains to complete a filter installation can be found in the section entitled "Filter Components".

Included in the CastKleen Filter Underdrain specifications are several blanks which must be filled in or decisions between alternatives which must be made to customize the specification for a given project. Each blank, series of blanks, or decision is footnoted. The appropriate footnotes appear at the bottom of the page on which the blanks or decisions are found. A version of these specifications without footnotes that is suitable for quick fill-in is available.

These specifications describe high quality equipment that is designed by the OVIVO Water Treatment Products Engineering Group with two objectives in mind, long life and minimal maintenance expense. While the intent underlying these specifications is to produce a product that will address the broadest possible range of applications, some situations may dictate modifications to the specifications. The Water Treatment Products Engineering Group has the design expertise and experience to address specialized needs. Contact the Water Treatment Products Group to develop solutions to specialized needs that can be incorporated into the specifications.

CastKleen Filter Underdrain (Pier Design) Specifications

SECTION 13220

FILTER UNDERDRAIN SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. There shall be furnished a filter underdrain system for a total of _____ () filter cells. The filter underdrain system shall be installed in the filter cells as shown on the Contract Drawings. The filter underdrain system will be designed to support the filter media without the need for filter gravel, collect filtered water, evenly distribute air for filter media cleaning, and evenly distribute backwash water.
- B. Each filter cell shall be ____ feet long by ____ feet wide.
- C. The filter underdrain system shall include setting of underdrain slab and support pier forms in place, installation of nozzle inserts in underdrain form panels, installing reinforcing bar, pouring the concrete support piers and underdrain slab, hydrostatic testing of the underdrain, installation of filter nozzles with tailpipes, and the testing of the entire system for air and water distribution. The entire filter underdrain system shall be designed to withstand with a prudent safety factor all stresses that may occur during the pouring of concrete, intermittent operation, or continuous 24 hour per day operation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | | |
|----|------------------------|-------------|
| A. | YARD PIPING AND VALVES | Division 2 |
| B. | CONCRETE | Division 3 |
| C. | MEDIA | Division 13 |
| D. | CONTROLS | Division 13 |
| E. | PIPING AND VALVES | Division 15 |

1.03 PROCESS REQUIREMENTS

A. The filter underdrain will support a [dual media] [single media] bed cleaned by water backwash, air scour, or a combination of the two. The intent of this specification is to obtain a filter underdrain capable of being an integral part of a filter system that will effectively remove turbidity, have long filter run times, and have low backwash water requirements without the need for oxidizing agents or other chemicals required for periodic cleaning of the filter media and underdrain system.

B. Design parameters are as follows:

Design filtration rate _____ gpm/ft²

Design backwash flowrate 25 gpm/ft²

Air scour pressure 6 psig

Air scour air flowrate 4 scfm/ft²

[Sand media depth _____ inches]

[Filter coal media depth _____ inches]

1.04 REFERENCES

A. ASTM A-53 Grade B American Society for Testing and Materials -
Pipe Specifications

B. AWWA B100 American Water Works Association -
Standards for Filter Media

1.05 QUALITY ASSURANCE

A. All parts that comprise the filter underdrain system, except for the concrete and reinforcing bar shall be designed and furnished by a single manufacturer. The manufacturer shall be responsible for the compatibility of all underdrain parts. In addition, the manufacturer must be regularly engaged in the manufacture of similar filtration equipment.

- B. The manufacturer of the filter underdrain system will modify his standard equipment to meet the minimum values specified for dimensions, design, and intent of this specification.
- C. The filter underdrain system will be supplied by Ovivo USA, LLC of Salt Lake City, Utah.

1.06 CONTRACTOR'S SUBMITTALS

- A. The Contractor shall submit complete shop drawings of all equipment furnished including cut sheets describing purchased sub-components with the specific sub-components used for this project properly highlighted. All submitted information must include a certification that the submittal describes exactly the equipment to be provided and substitutions subsequent to submittal approval will not be tolerated.
- B. The Contractor shall submit for approval a minimum of the following information:
 - 1. Detailed general arrangement drawings showing design loadings, location of all support piers including size and location tying of reinforcing bar, anchorage to the filter cell walls and floor, and sufficient information describing the underdrain form panels, nozzle inserts, and nozzles to determine compliance with the specifications.
 - 2. Calculations to determine the headloss for filtration, water backwash, air scour, and combined air/water backwash.
 - 3. Detailed installation instructions specific for this project, including specifications for the underdrain concrete composition, pouring, finishing, and testing.
- C. Submittal information must be stamped by a Registered Professional Engineer.

1.07 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be provided by the equipment manufacturer at least two weeks prior to shipment of all major equipment components. Each manual shall be a bound, indexed binder prepared specifically for this project rather than general equipment instructions.

- B. As a minimum the manual shall contain:
1. General arrangement drawings.
 2. General arrangement detail drawings.
 3. Erection drawings.
 4. A complete bill of materials for the equipment.
 5. Cut sheets for all items of equipment purchased from other manufacturers.
 6. Installation and maintenance instructions for the specific equipment including the erection sequence, maintenance items, and trouble-shooting check points.

1.08 DELIVERY

All components must be boxed and adequately marked for ease of erection.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The cast-in-place underdrain system shall consist of support pier forms, molded underdrain form panels with nozzle inserts, nozzle tailpipes, and nozzles all constructed of ABS plastic and imbedded in a cast-in-place monolithic concrete underdrain slab, as shown on the Contract Drawings. In addition, an air distribution header shall be furnished and installed. Provisions shall be made in the concrete support piers for the equal distribution of air under the underdrain slab.
- B. The monolithic underdrain system shall be capable of supporting a vertical downward load of 1,500 pounds per square foot and a vertical upward load of 1,200 pounds per square foot. A keyway shall be cast into the filter cell walls to distribute shear loads at the cell wall/monolithic floor interface for both upward and downward loads.

2.02 UNDERDRAIN FORM PANELS

- A. Plastic underdrain form panels shall be supplied to provide shape for the filter underdrain system. The plastic used shall be food grade ABS.
- B. The underdrain form panels shall be of sufficient strength to withstand all loads imposed by the pouring of concrete, and sealable to prevent separation during the pouring of concrete. The forms shall be constructed so that underdrain nozzles can be installed uniformly on 8 inch centers in the completed underdrain slab.
- C. Underdrain forms shall be 24 inches wide and 48 inches long and NSF 61 approved.

2.03 PIER FORMS

- A. Pier forms shall be provided to form the underdrain support structure. Pier forms shall interlock with the underdrain form panels to provide for a simultaneous pier/slab concrete pour.
- B. The pier forms shall be 6 inches in diameter and shall be spaced 24 inches in one direction and 48 inches in the other direction for easy access to the underdrain plenum.

2.04 NOZZLE INSERTS

- A. Nozzle inserts constructed of ABS plastic shall be supplied. Provision shall be made for the nozzle inserts to snap into the underdrain form panels. In order to provide a smooth, flat mounting surface for the underdrain nozzles that will preclude damage to the nozzles, a nozzle mounting collar of the same or larger diameter than the nozzle will be provided.
- B. Lugs shall be provided as a part of the nozzle insert so that reinforcing bar can be locked into place at the proper elevation to insure sufficient cover for the reinforcing bar and proper location of the reinforcing bar for maximum strength.
- C. Each nozzle insert shall have an ABS plastic nozzle mounting collar to provide an easily cleaned, smooth, flat mounting surface for the media support and collection nozzle. The nozzle mounting collar will be positioned beneath and retained by the nozzle insert. Nozzle mounting collars will be at a minimum, the full diameter of the nozzle.
- D. Removable plastic caps shall be provided to protect the insert nozzle threads and

full diameter of the mounting collar during the concrete pour. Included with the plastic cap will be a neoprene O-ring to seal the nozzle during hydrostatic testing.

2.05 UNDERDRAIN NOZZLES

A. Underdrain nozzles shall be injection molded of a three-monomer multi-polymer formulated for heat stability, chemical resistance, aging resistance, low-temperature property retention, toughness, impact strength, surface smoothness, rigidity, and processing ease.

B. Multi-polymer properties shall be as follows:

- Yield tensile strength 6,000 psi
- Yield flexural strength10,500 psi
- Rockwell hardness (Method A)..... R103
- Izod impact strength..... 6.5 ft-lb/in notch
- Deflection temperature at 66 psi fiber stress 95 °C

C. Maximum spacing of underdrain nozzles in both the lateral and longitudinal directions shall be 8 inches on centers.

D. To minimize filter media displacement, nozzles may not exceed 1¹/₂ inches in height.

E. Nozzles shall have circular perimeters and generally flat tops. Perimeters shall contain vertical slots designed to retain [0.36] [0.20] millimeter or larger media. The slot width shall taper, opening toward the inside, so smaller particles passing the entrance to the slots will not become lodged in the slots.

F. An integral cone and baffle must be molded inside the nozzle head to direct backwash flows in a radial pattern, intersecting patterns of adjacent nozzles.

G. Nozzle slots shall present a total open area of not less than 1.1 square inch per nozzle. Backwash water departure angle (normal to slot face slope) shall be 15°.

H. Test results shall be furnished, showing filtering headloss through production grade nozzles on 8 inch centers in 13°C water, including the effect of fine media obstructing the slots is between 2 and 3 inches of water at 3 gpm/ft² . Test results

shall be furnished, showing backwashing headloss under the above conditions, to be between 12 and 15 inches of water at 15 gpm/ft².

2.06 NOZZLE TAILPIPES

- A. Nozzle tailpipes shall be provided to assure the uniform distribution of air during air scour. The tailpipes shall be constructed of ABS plastic with flow control orifices located and sized for the specific air wash requirement of the filter.
- B. The tailpipes shall be designed so that they are adjustable plus or minus 1 inch, to compensate for the underdrain slab not being level.

2.07 AIR DISTRIBUTION HEADERS

- A. PVC air distribution headers shall be provided to evenly distribute air beneath the underdrain slabs. The headers shall be properly sized for the air scour flow, with flow distribution orifices to assure uniform air distribution.
- B. Calculations shall be submitted, demonstrating uniform distribution from the air header.

2.08 SPARE PARTS

As a minimum, the following spare parts will be furnished:

- 2% extra underdrain form panels
- 2% extra nozzle inserts
- 2% extra nozzle tailpipes
- 2% extra nozzles

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The underdrains shall be installed in accordance with the manufacturer's recommendations as approved by the Engineer.

- B. Prior to installation of the media, the Contractor shall vacuum clean all surfaces that might come in contact with the filtered water or backwash water.
- C. Following media placement, the media shall be thoroughly washed and cleaned in accordance with AWWA B100.
- D. Prior to start-up of the granular media filter equipment, a field service engineer employed directly by the granular media filter manufacturer shall inspect the equipment, make necessary final adjustments and certify the equipment ready for operation.

3.02 SERVICE

- A. The equipment manufacturer shall supply a factory trained field service representative to inspect the installation of the filter underdrains. In addition, the field service representative shall instruct the owner's personnel in the proper operation and maintenance of the filter underdrains. As a minimum, the manufacturer's field service representative must be available for ____ days of service in ____ separate trips.
- B. Service by a representative of the filter underdrain manufacturer who is not a direct, full time employee of the filter underdrain manufacturer is not acceptable.

3.03 PERFORMANCE DEMONSTRATION TEST - OPTIONAL

- A. After start-up and prior to final acceptance, the Contractor shall conduct Engineer witnessed performance demonstration tests on the filter underdrains.
- B. The specific tests to be performed will be developed by the manufacturer and be subject to approval by the Engineer. Test procedures shall be submitted to the Engineer for approval with submittal drawings. Tests will be scheduled with the Engineer at least two (2) weeks prior to the planned test date.
- C. After the underdrain system has been cast, and before nozzles are installed, the underdrain system shall be tested for integrity and structural strength. A hydrostatic head of 10 feet shall be placed on the underside of the underdrain and maintained for 24 hours. The underdrain slab shall be checked for integrity and the test witnessed by a field service representative of the manufacturer. A certified report shall be submitted to the Engineer.
- D. After the nozzles are installed, and before the filter media is put into the filter, the

filter underdrain system shall be tested for uniform air scour distribution and combined air scour water backwash distribution. Air distribution shall be uniform within 10% over the entire range of operation. The test shall be witnessed and certified by a manufacturer's field service representative.

- E. The field service representative shall submit to the Engineer a written report stating that the filter underdrain systems have been checked and are suitable for operation.
- F. Inspection by a representative of the manufacturer who is not a direct, full time employee of the manufacturer is not acceptable.

END OF SECTION 13220