

Installation, Operation and Maintenance Manual

Revision: A

For:

Glasgow Water System Improvements Project
Glasgow, Montana

Equipment:

Gravity Filter Parts for Four (4) 15 Feet x 12 Feet Cells
Specification Section: 11380 Filter Underdrain System
WesTech Model GFPB20

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WesTech Job Number: 23711B
June 2019

The logo for WesTech, featuring the word "WESTECH" in a bold, blue, sans-serif font. The "W" is significantly larger and more stylized than the other letters, which are in a standard weight. The letters are all in blue.

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Revision History

Revision	Date	Comments
-	2019/3/14	Original Release
A	2019/6/13	Added Equipment Maintenance Summary Sheet



For:

Glasgow Water System Improvements Project
Glasgow, Montana

Equipment:

Gravity Filter Parts for Four (4) 15 Feet x 12 Feet Cells
WesTech Model GFPB20

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WesTech Corporate Services

Parts / Field Service / Training

- 24 Hour Hot-Line
- Full Service Parts Department
- Installation and Erection Services
- Mechanical Evaluations / Process Audits
- Operator Training
- Process Training
- Regional Service Technicians
- Service and Maintenance Agreements

Laboratory and Pilot Plant Testing

- Bench Scale Feasibility Testing
- Field Pilot Testing / Studies
- Plant Process Audits

Services

- Bench Scale Feasibility Testing
- Field Pilot Studies
- Installation and Erection Services
- Mechanical Evaluations
- Plant Process Audits

Pilot Rental Equipment

- AERALATER® - Aeration, Detention, and Filtration
- AltaFlo™ High Rate Thickener
- Buoyant Media Clarifier
- CONTRAFast®- C
- CONTRAFast®- E
- CONTRAFLO®
- Denitrification Filtration
- Dissolved Air Flotation
- Dual-Column Filtration
- Forced Draft Aerator
- High Rate Thickener
- Horizontal Belt Filter
- Inclined Plate Settler
- Linear Screen
- Microfiltration/Ultrafiltration
- Nanofiltration/Reverse Osmosis
- Paste Thickener
- Precoat Filter
- Pressure and Gravity Filter
- RapiSand™ Ballasted Flocculation
- solids CONTACT CLARIFIER™
- SuperSand™
- SuperDisc™
- Vacuum Drum Filter
- Trident®, Trident® HS



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www.westech-inc.com

WesTech Municipal Water Products

Aeration

- ATOMERATOR™
- Cascade Aerator
- Forced Draft Aerator
- Induced Draft Aerator

Adsorption

- Adsorption Clarifier®
- Cation Exchange Softener
- Granular Activated Carbon (GAC) Contactor

Covers

- Zickert Retractable Membrane Cover

Electrical Controls

- PLC Based Control System
- UL Listed Panels (UL508A/UL698)

Flocculation

- Horizontal Paddle Wheel Flocculator
- Vertical Paddle Wheel Flocculator

Granular Media Filtration

- ANTHRA/SAND™ Manganese Removal Media
- CentROL® LP Cluster Filter
- Circular and Rectangular Open Top Gravity Filter
- ESSD™ Filter Trough
- MULTIWASH® Filtration Process
- MULTIBLOCK® Underdrain
- MULTICRETE™ II Underdrain
- Multi-Tech™ Multiple Barrier Filtration System
- Horizontal Pressure Filter
- Vertical Pressure Filter

Membrane Filtration

- Microfiltration/ Ultrafiltration
- Nanofiltration/Reverse Osmosis
- VersaFilter™

Residuals Handling

- Backwash Water Clarifier
- Decanter Mechanism
- Gravity Sludge Thickener
- SuperSettler™ Inclined Plate Settler
- Vacuum Drum Filter

Package Treatment Plants

- AERALATER® Iron and Manganese Removal Plant
- AltaPac™ Ultrafiltration Membrane System
- Aquarius™ Conventional Package Plant
- Tri-Mite™ Package Plant
- Trident® Package Water Treatment System
- Trident® HS Multi Barrier Package Plant
- Water Boy™ Package Plant

Sedimentation/Clarification

- Adsorption Clarifier®
- Conventional Clarifier
- CONTRAFLO® Solids Contact Clarifier
- CONTRAFAST® High Rate Clarifier/Thickener
- Flocculating Clarifier
- RapiSand™ Ballasted Flocculation
- Sludge Sucker™ Sludge Siphon Clarifier
- solids CONTACT CLARIFIER™
- SPIRACONE™ Clarifier
- SuperSettler™ Inclined Plate Settler
- Trident® HSC Multi-Barrier Clarifier
- Zickert Shark™ Sludge Removal

Softening

- Cation Exchange Softener
- CONTRAFLO® Solids Contact Clarifier
- CONTRAFAST® High Rate Clarifier/Thickener
- solids CONTACT CLARIFIER™

Tankage

- Anchor Channel Tank
- Flat Bottom Tank
- Elevated Tank

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WesTech Municipal Wastewater Products

Anaerobic Digestion Equipment

- Cleanergy Biogas Generator
- Digester Cover - Radial Beam Style
- Digester Cover - Truss Style
- DuoSphere™ Dual-Membrane Gas Holder
 - Slab and Tank Mount
- Extreme Duty™ Mechanical Sludge Mixer
- Sludge Heating System

Biological Treatment

- BioDoc™ Rotary Distributor
- ClearLogic™ MBR System
- HydroDoc™ Rotary Distributor
- Landex™ Oxidation Ditch
- OxyStream™ Advanced Oxidation Ditch Process
- Package Plants
- RSD1™ Rotary Distributor
- Slow Speed Surface Aerators
- STM-Aerotator™ IFAS Systems

Clarifiers

- C.O.P™ Clarifier Optimization Package
 - Spiral Blades
 - Sludge Ring
 - Dual Gate EDI
- Conventional Scraper Blade
- RapiSand™ Ballasted Flocculation
- solids CONTACT CLARIFIER™
- Suction Header
- Suction Pipe
- Zickert Shark™

Combined Sewer Overflow

- ROMAG CSO Screens
- WWETCO FlexFilter™
- WWETCO FlexFlo™ Control Valve

Dissolved Air Flotation

- Algae Removal
- Pretreatment Clarifiers
- Rectangular & Circular
- Sludge Thickeners

Electrical Controls

- PLC Based Control Systems
- UL Listed Panels (UL508A/UL698)

Filters

- CenTROL® LP Cluster Filter
- MULTIWASH® Filtration Process
- SuperSand™ Continuous Backwash Filter
- SuperDisc™ Cloth Media Disc Filter
- Trident® Package Plant
- WWETCO FlexFilter™

Headworks

- CleanFlo™ Rotoscreen® Fine Screen
- CleanFlo™ Monoscreen® Fine Screen
- CleanFlo™ ALL-IN-ONE (Complete Plant)
- CleanFlo™ Element Continuous Belt Screen
- CleanFlo™ MultiRake
- CleanFlo™ Shear (Internally Fed Rotary Drum Screen)
- CleanFlo™ Spiral Screen (Inclined and Vertical)
- CleanWash™ Screw Wash and Counter Pressure Screw
- CleanGrit™ Grit Washers
- Gritt Mitt™ Grit Classifiers
- Shaftles Spiral Conveyor and Compactor
- Vortex Grit Separators
- Zickert Shark™ Grit and Grease Removal

Membrane Filtration

- Microfiltration/Ultrafiltration
- Nanofiltration/Reverse Osmosis
- VersaFilter™

Rectangular Basin Skimming

- Helical Scum Skimmers
- Rotating Scum Pipes
- Zickert Skimmer

Replacement Drives

- Adaptable to All Other Manufacturers
- Clarifiers
- Grease Lubricated Option
- Precision Bearing
- Thickeners

Septage Receiving Station

- Customer Management / Billing Software
- Hauler Access Stations
- Screening and Grit Removal Options

Tankage

Field Erection
Material Supply

Thickeners

Center Feed
CleanFlo™ Rotary Drum Thickener
DAF Thickening
Rake Lifting Devices
Side Feed

WesTech Industrial Water and Wastewater Products

Aeration

Cascade Aerator
Forced / Induced Draft Aerator

Barrier / Media Filtration

AERALATER® Iron / Manganese Removal
AltaPac™ Ultrafiltration Package Systems
Cation Exchange Softeners
Circular or Rectangular Gravity Filter
CentROL® LP Cluster Filter
GAC Contactors
Microfiltration/ Ultrafiltration
Multi-Tech™ Multiple Barrier Filtration System
MULTIWASH® Filtration Process
Nanofiltration/ Reverse Osmosis
Pressure Filter (Vertical or Horizontal)
Self Stored Backwash Filter
SuperDisc™ Cloth Media Disc Filter
SuperSand™ Continuous Backwash Filter
Tri-Mite™ and Trident® Package Treatment
Trident® HS Package Plant
VersaFilter™ Membrane Filtration
Water Boy™ and Aquarius™ Package Plant
WWETCO FlexFilter™

Biological Treatment

BioDoc®/ HydroDoc Rotary Distributor
Biotreater
Cleanergy Biogas Generator
ClearLogic MBR Systems
DuoSphere™ Dual Membrane Gasholder
Slab or Tank Mount
HydroDoc™ Rotary Distributor
Oxidation Ditches
Slow Speed Surface Aerators
STM Aerotor™ IFAS Systems
UASB – Upflow Anaerobic Sludge Blanket

Clarification / Sedimentation

Backwash Clarifier
Buoyant Media Clarifier
Conventional Clarifier
Cooling Tower Slip Stream Treatment
COP™ Clarifier
Draft Tube™ Clarifier
CONTRAFast® High Rate Clarifier/Thickener
Flocculating Clarifier
Metallurgical Contact Clarifier

Rapisand™ Ballasted Flocculation
Rim Drive Clarifiers
Scale Pit Scraper/Skimmer
Sludge Sucker
SPIRAcone™ Clarifier
solids CONTACT CLARIFIER™
Suction Header COP
Suction Pipe Clarifiers
SuperSettler™ Inclined Plate Settler
Traveling Bridge Clarifiers
Zickert Shark™ Sludge Removal

Clarifier / Thickener Drives

Bridge Supported Shaft Drive
Column Supported Cage Drive
PasteThick™ Drive
Replacement, Retrofit, and Rebuild Options
for All Manufacturers
Titan Traction™ Drive

Dewatering

Belt Press
Ceramic Disc Filter
Horizontal Vacuum Belt Filter
Precoat Drum Filter
Recessed Plate Filter Press
Rotary Vacuum Disc Filter
Rotary Drum Vacuum Filter
Tower Press

Dissolved Gas Flotation

Circular
Rectangular

Electrical Controls

PLC Based Control Systems
UL Listed Panels (UL508A / UL698)

Oil / Water Separation

DAF Units (Circular or Rectangular)
DNF Units (Circular or Rectangular)
Oil / Water Separator (Circular or Rectangular)
Scale Pit Skimmer/Scraper

Screens

CleanFlo™ Rotoscreen®
CleanFlo™ Monoscreen®
CleanFlo™ ALL-IN-ONE (Complete Plant)
CleanFlo™ Element Continuous Belt Screen

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CleanFlo™ Shear (Internally Fed Drum Screen)
CleanFlo™ Spiral Screen (Inclined and Vertical)
CleanWash™ Screenings Washer / Compactor
Counter Pressure Screw
CleanGrit™ Grit Washers
Gritt Mitt™ Grit Classifiers
Vortex Grit Separators
Zickert Shark™ Grit and Grease Removal

Softening

Cation Exchange Softener
Cold Lime Softener
Warm Lime Softener

Tankage

Anchor Channel Tank
Elevated Tank
Steel Bottom Tank
Supply and / or Field Erection

Thickeners

AltaFlo™ High Rate Thickener
Conventional Thickener
Deep Bed™ Paste Thickener
HiDensity™ Paste Thickener
HiFlo™ High Rate Thickener
Swing Lift Thickener
Traction Drive Thickener
TOP™ Thickener Package

WesTech Industrial Mining and Metallurgical Products

Clarifiers

Buoyant Media Clarifier
Flocculating Clarifier
Metallurgical Contact Clarifier
RapiSand™ Ballasted Flocculation
Solids CONTACT CLARIFIER™
CONTRAFast® High Rate Clarifier/Thickener
SuperSettler™ Inclined Plate Settler

Heavy Duty Drives

Bridge Supported Shaft Drive
Column Supported Cage Drive
PasteThick™ Drive
Retrofit and Rebuild Options for All Manufacturers
Titan Traction™ Drive

Granular Media Filtration

CentROL® LP Cluster Filter
Circular & Rectangular Gravity Filter
MULTICELL® Horizontal Pressure Filter
Multi-Tech™ Multiple Barrier Filtration System
MULTIWASH® Filtration Process
Self-Stored Backwash Filter
SuperSand™ Continuous Backwash Filter
Vertical Pressure Filter
WWETCO FlexFilter™

Man Camp Potable Water Treatment

AltaPac™ Ultrafiltration Package System
Tri-Mite™ & Trident® Package Plant
Water Boy™ & Aquarius™ Package Plant

Man Camp Wastewater Treatment

BioTreater
ClearLogic™ MBR System
STM-Aerotator™ IFAS Package System

Membrane Filtration

AltaPac™ Ultrafiltration Package System
Microfiltration/ Ultrafiltration
Nanofiltration/ Reverse Osmosis
VersaFilter™

Screens

CIP / CIL, RIP/RIC Media Retention Screen
Linear Trash Screen
Screw Classifiers

Tankage

Anchor Channel Tank
Elevated Tank
Steel Bottom Tank
Supply and / or Field Erection

Thickeners

AltaFlo™ High Rate Thickener
Conventional Thickener
Deep Bed™ Paste Thickener
HiDensity™ Paste Thickener
HiFlo™ High Rate Thickener
Swing Lift Thickener
TOP™ Thickener Package

Dewatering

Disc Filter
Horizontal Belt Filter
Precoat Drum Filter
Rotary Drum Filter
Belt Discharge
Roll Discharge
Scraper Discharge
Tower Press

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Warning Summary

WesTech recommends that this page be thoroughly read and understood before erecting and operating the equipment. The procedures must be followed as WesTech will not accept responsibility for damage to equipment that has not been handled in accordance with the manufacturer's instructions. A brief summary of the warnings are listed below.

Operating and maintaining this equipment has inherent risks. It is your responsibility to read and understand the Installation, Operation and Maintenance Manual prior to working with the equipment. This page is intended to summarize the warnings associated with WesTech's equipment. Where equipment manufactured by others has been provided in conjunction with WesTech equipment, additional warnings specific to that piece of equipment may only be contained in that section of the manual. Please read and understand all warnings provided in this manual.

Failure to observe warnings listed in this manual for WesTech Equipment or other manufacturer's equipment listed in the Operations and Maintenance Manual may void WesTech's Warranty.

Section One Warnings

- Stand clear as equipment is lifted.

Section Three Warnings

- Filter media retaining underdrains furnished by WesTech are designed for use in municipal and industrial water and waste water treatment filters. All filters utilizing these underdrains will require backwashing with filtered water only. Should any filter equipped with our media retaining underdrains be backwashed with unfiltered, dirty, debris-laden backwash supply water, the underdrain will become plugged. Underdrain failure is possible unless they are maintained in a clean, free flow state.

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Section One: Equipment Information

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Warranty

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One Year Warranty

WesTech equipment is backed by WesTech's reputation as a quality manufacturer, and by many years of experience in the design of reliable equipment.

Equipment manufactured or sold by WesTech Engineering, Inc., once paid for in full, is backed by the following warranty:

For the benefit of the original user, WesTech warrants all new equipment manufactured by WesTech Engineering, Inc. to be free from defects in material and workmanship, and will replace or repair, F.O.B. its factories or other location designated by it, any part or parts returned to it which WesTech's examination shall show to have failed under normal use and service by the original user within one (1) year following initial start-up, or eighteen (18) months from shipment to the purchaser, whichever occurs first.

Such repair or replacement shall be free of charge for all items except for those items such as resin, filter media and the like that are consumable and normally replaced during maintenance, with respect to which, repair or replacement shall be subject to a pro-rata charge based upon WesTech's estimate of the percentage of normal service life realized from the part. WesTech's obligation under this warranty is conditioned upon its receiving prompt notice of claimed defects, which shall in no event be later than thirty (30) days following expiration of the warranty period, and is limited to repair or replacement as aforesaid.

This warranty is expressly made by WesTech and accepted by purchaser in lieu of all other warranties, including warranties of merchantability and fitness for particular purpose, whether written, oral, express, implied, or statutory. WesTech neither assumes nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever.

This warranty shall not apply to equipment or parts thereof which have been altered or repaired outside of a WesTech factory, or damaged by improper installation, application, or maintenance, or subjected to misuse, abuse, neglect, accident, or incomplete adherence to all manufacturer's requirements, including, but not limited to, Operations & Maintenance Manual guidelines & procedures.

This warranty applies only to equipment made or sold by WesTech Engineering, Inc.

WesTech Engineering, Inc. makes no warranty with respect to parts, accessories, or components purchased by the customer from others. The warranties which apply to such items are those offered by their respective manufacturers.

General Precautions

The erection instructions enclosed are provided to assist in the assembly and adjustment of this mechanism. These procedures are not intended as a substitute for the experience of the persons assigned to erecting and assembling this equipment. WesTech strongly suggests that these instructions be studied prior to erecting, assembling, and adjusting.

During assembly of this equipment, it will be necessary to install, adjust, and maintain certain accessory items not manufactured by WesTech. This accessory equipment must be stored, handled, adjusted, and maintained in accordance with instructions provided by the manufacturer of that equipment. This is absolutely necessary in order to be assured of prompt and full participation in the warranty protection on the equipment. WesTech will not accept responsibility for damage to equipment that has not been handled in accordance with the manufacturer's instructions.

Packing List

The Contractor's packing list consists of a sheet containing an itemized listing of parts.

The packing list contains:

1. A description of the item.
2. Sizes and lengths of nuts and bolts. These fasteners will ship tagged with the item numbers.
3. The quantity of parts per assembled unit.
4. Total quantity of parts shipped.
5. An indication of direct shipment from the supplier or the fabricator.
6. The date and job number of the shipment.

The packing list will be found in one of the crates shipped directly from WesTech Engineering. The list should be kept in a readily accessible and safe place. Many contractors prefer to keep this list in some type of binder for protection and quick reference.

This list is particularly useful during erection for locating small parts and fasteners. When coordinated with the erection drawings, equipment tagging, and piece marking, the contractor's packing list can become an invaluable erection tool.

Equipment Tags

Each shipping piece has been tagged or piece marked for convenience. Typically, the part number and item number will be marked on all items. Piece marked items received will have a mark such as "Part No. D120A" or "Item 20," which may be cross-referenced with the packing list and general erection drawings.

Receiving Material

The equipment pieces and components received may have been shipped from:

1. WesTech Engineering, Inc.
2. A fabricator acting under WesTech Engineering, Inc. instructions.
3. A "buy-out" distributor such as a motor or pump manufacturer.

Since there will often be more than one shipment to the job site, it is important to coordinate the receiving and storage of all items accordingly. All material has been thoroughly checked and inspected before shipment. However, there may be times when equipment is missing, damaged in transit or received with broken packaging. When receiving equipment, it is necessary to properly acknowledge receipt and any shortage or damage on the shipping documents. This must be done in a manner that helps assign responsibility to the proper party for the various parts of shipping and receiving equipment.

When receiving a shipment, the following procedures must be followed. These procedures are also listed on the Bill of Lading the shipping company provides and must be signed to prove delivery of the goods. If the following procedures are not followed, WesTech will not be liable for any shortages or damage on your shipments.

Receiving Procedure

1. Before signing the Bill of Lading (BOL) in receipt of the goods shown thereon, and before the driver leaves, do the following:
 - a. After inspecting the shipment, note any damage or shortages (according to what is listed on the BOL). Be as detailed as necessary.
 - b. Have the driver sign the notation in acknowledgment.

- c. Retain a copy (of the notated BOL) for use in filing a freight claim.
 - d. If there is damage, notify WesTech (801) 265.1000 immediately so that arrangements can be made with the carrier, if necessary, to have the damaged goods inspected by their agent.
- 2. After signing the BOL and receiving the shipment, do the following:
 - a. Use the attached/enclosed packing list to further inspect the entire shipment for shortages and/or damage, and retain this list for future reference.
 - b. Notify WesTech within three working days from date of receipt of any further shortages or concealed damage. If certain items are missing or damaged, make notes of this on the shipping papers to protect all interests and notify WesTech (801) 265.1000 immediately.

Handling and Storage

Please handle the equipment properly when unloading and erecting. All cartons, electrical equipment, and gear drives should be stored under cover and protected from moisture, grit, and mud. All rolled steel sections must be stored on edge or blocked up to prevent distortion. If allowed to lie flat, these items may lose their shape, which could hinder erection and proper alignment of the equipment.

Long structural shapes should be checked for the proper camber. This would include beams, trusses, walkways, etc. The equipment has been designed with a positive camber so items do not appear to be sagging after erection.

Painting

The material supplied for this job has received surface preparation and paint in accordance with the specific contract plans and specifications.

Any indentations, marks, and/or scratches caused by loading and unloading the equipment must be immediately touched up in the field prior to storage.

Shop Primer Paint Durability

In the event the equipment supplied has been painted with only a primer coat, this notification should be adhered to. Shop primer paints are intended to serve only as a bonding coat between the metallic surface and the protective finish and serve only as a minimal protective finish. Unless otherwise noted in the contract documents, WesTech will not be responsible for condition of primed or finish painted surfaces after the equipment leaves our shops. Customers are invited to inspect coatings in our shops for proper surface preparation and application prior to shipment. WesTech assumes no responsibility for field surface preparation or touch up of shipping damage to paint. Painting of surfaces requiring touch up or painting of fasteners will be by the customer's painting contractor after the mechanism is erected.

Shop primed surfaces should be finish coated within the time specified by the paint manufacturer. WesTech cannot be held responsible for shop-primed surfaces that have deteriorated due to time and exposure.

Fasteners

All stainless steel erection fasteners shall incorporate anti-seize during assembly. Failure to utilize this will cause significant extra time by the erection and maintenance crews.

Foundation Anchor Bolts

If required, WesTech Engineering ships anchor bolts direct to the job site upon receipt of the approved prints. Notify WesTech immediately if anchor bolts are not received as promised.

Anchor bolts must be placed accurately to avoid future erection difficulties. Where applicable and upon request, WesTech can furnish a template for positioning the anchor bolts. If a template has

not been furnished, remember that the location and projection of all anchorage is critical. The specified amount of projection and location are shown on the general arrangement drawings. Prior to equipment installation, clean the threads of all anchorage bolts and oil them.

If using epoxy anchors, confirm the expiration date of the epoxy, typically posted on the packing, prior to mixing and application. WesTech will guarantee the effectiveness of the epoxy up to the aforementioned date. Installer is to adhere to epoxy installation procedures noted on packaging.

Installation, Operation and Maintenance Manual

Keep an Installation, Operation and Maintenance Manual in the area where the operators can familiarize themselves with it and have it for reference. The manual is useless if the operator and foreman do not have access to it.

Further Assistance

If a problem is encountered while installing or operating the equipment that cannot be solved by referring to this manual, feel free to contact

WesTech Engineering, Inc.
600 Arrasmith Trail
Ames, Iowa 50010
Phone: (515) 268.8400
Fax: (515) 268.8500
24 Hour Emergency Assistance: (801) 265.1000

Shortages, Discrepancies and Field Changes

Please notify WesTech Engineering, Inc. immediately if any apparent manufacturing discrepancies or shortages are encountered with machinery, since no field charges for alterations or shortages will be accepted unless authorized in writing by our authorized representative.

Fabricated steel parts and assemblies furnished by WesTech Engineering, Inc. are manufactured following best shop practices and standards. However, some misfits and imperfect work may arise. In such cases, the American Institute of Steel Construction Manual, Thirteenth Edition, "Code of Standard Practice" will apply to erection of this equipment. It reads as follows:

"7.14. Corrections and Errors

The correction of minor misfits by moderate amounts of reaming, grinding, welding or cutting, and the drawing of elements into line with drift pins, shall be considered normal erection operations. Errors that cannot be corrected using the foregoing means, or that require major changes in member or Connection configuration, shall be promptly reported to the Owner's Designated Representatives for Design and Construction and the Fabricator by the Erector, to enable the responsible entity to either correct the error or approve the most efficient and economical method of correction to be used by others."

Commentary:

"As used in this Section, the term "moderate" refers to the amount of reaming, grinding, welding or cutting that must be done on the project as a whole, not the amount that is required at an individual location. It is not intended to address limitations on the amount of material that is removed by reaming at an individual bolt hole, for example, which is limited by the bolt-hole size and tolerance requirements in the AISC and RCSC Specifications."

Company policy dictates that no field charges will be allowed without prior approval. Written authority must be given in the form of a WesTech Inspection and Change Work form with an attached warranty tracking number. The Warranty tracking number will be issued when the extent of such modifications and the price for performing these modifications have been agreed upon.

In general, when parts require replacement, and WesTech agrees that replacement is necessary, WesTech will furnish the parts. The contractor will remove the defective parts and install the replacement parts at a cost agreed upon by both parties.

Structural Lifting Precautions

Do not pull, drag, push or dump the structural components off the delivery trucks.

All structural components should be lifted and handled as instructed below. Proper handling is necessary to protect special coverings and to ensure ease of assembly during equipment installation.

WesTech will not accept charges for repair or replacement of equipment or materials damaged due to improper handling. Report any damage to WesTech, and make a notation on shipping papers to this effect.

Lifting Recommendations

Observe these precautions when lifting or handling structural components.

Stand clear as the equipment is lifted.

1. Make sure the equipment being lifted or the lifting equipment cannot come into contact with overhead electrical cables, etc.
2. Make sure the rigging and hoist equipment have adequate capacity. Weights for major components are listed on the Parts Lists in the Enclosures Section.
3. All rigging and lifting should be done by experienced personnel.
4. Before equipment is removed from delivery trucks, check to be sure the blocking, bracing and banding securing it to the carrier have been removed and it is ready for moving.
5. Use multiple point lifting whenever possible.
6. When lifting structural members of this equipment, such as rake arms, cages, walkways, etc., avoid twisting or bending the members. Use spreader beams, as necessary, to fully support the pieces as they are lifted.
7. Make sure shop provided camber is maintained when lifting rake arms and walkways.
8. Lift the equipment an inch or two off the trailer to be sure it is free to be moved and balanced correctly. Adjust as necessary.
9. Never move the equipment suddenly or in jerks, and never allow it to strike the ground, tank or other equipment.

Pertinent Data

Performance

1. Number of Filter Cells: 4
2. Cell Size: 15 ft x 12 ft
3. Filtering Area: 1/80 sq. ft. total
4. Filtering Rate: 4 gpm/sq. ft. = 720 gpm
5. Airwash Rate: 5 CFM/sq. ft. = 900 CFM
6. Waterwash Rate: 20 gpm/sq. ft. = 3600 gpm
7. Backwash Water Source: Backwash pump
8. Backwash Control: Butterfly valves

Filter Specifications

1. Filter Media: Dual Media – Sand and Anthracite
2. Type of Underdrain: WesTech Media Retaining MULTIBLOCK
3. Underdrain Height: 12"
4. Filter Media Bed Depth: 12" Sand, 18" Anthracite

Washtroughs Specifications

1. Number Per Cell: 2
2. Size: 18" Wide x 19" Deep x 16'-7" Long
3. Material: 304 Stainless Steel

Air Distribution Header

1. Size: 6" Header with 1 ¼" Risers
2. Material: 316 Stainless Steel

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Section Two: Installation Instructions

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Airwash Header Installation

1. It is assumed the airwash header supply nozzles (not by WesTech) have been installed through the cell walls per reference drawings.
2. Dry fit airwash header to supply nozzle using the attached flange. Check that the location of the first riser will fit through the hole of the MULTIBLOCK flume block when it is positioned properly.
3. Bolt flange on header to supply nozzle using bolts, nuts, and gaskets. Use supplied header support brackets to help support the header as required.
4. Install airwash header support brackets using supplied anchors. Locate brackets per reference drawings.

MULTIBLOCK™ Underdrains Precautions

Read entire instructions before installing this underdrain system. If instructions are not followed in detail, the underdrain may be structurally unsound and distribution may be adversely affected.

Note: American Concrete Institute (ACI) specifications must be adhered to when creating, placing, and working concrete unless other methods are expressly documented in this manual. ACI 305 “Hot Weather Concreting” must be followed when installing underdrains at temperatures above 80 °F (26.7 °C) and ACI 306 “Cold Weather Concreting” must be followed when installing underdrains at temperatures below 40 °F (4.4 °C) to prevent cracking.

Note: Underdrain should be placed in a timely fashion to prevent unnecessary curing before installation is complete. This is especially a concern when placing concrete in locations with hot weather or low relative humidity.

Caution: Cleaning is especially important on existing filters retrofitted with WesTech MULTIBLOCK™ underdrains using media retaining Laser Shields with media retaining slots. It is imperative that all existing backwash supply piping, backwash supply basins and existing underdrains with interconnecting piping to retrofitted underdrain sections be free of media and debris.

WesTech is not responsible for cleaning and repair if a new retrofitted underdrain fails due to reverse plugging of underdrains by pre-existing contaminated sources of backwash water.

Instructions for MULTIBLOCK™ Gravity Filter Underdrains

Preliminary Procedures

WesTech Engineering normally includes field service time to allow for an inspection of the underdrain placement. Arrangements for this inspection should be made by the contractor so that the inspection can be made prior to the base concrete pour. WesTech Engineering will not be responsible for modifications required to correct installations after concrete is poured improperly.

The contractor shall install the filter underdrain in strict accordance with this manual and the installation drawings provided.

Check filter basin wall and floor dimensions to assure that all dimensions are in accordance with WesTech Engineering reference drawings. Underdrain must be installed level. Each lateral should be level to within 3/16". Between laterals, the level should be within +1/4" from grade across each filter basin. Levels should be taken at the center of the various blocks. If floor is 1" or more out of level, it is recommended to level low spots before commencing installation. If leveling is required, grout must be allowed to set before commencing installation.

Filter basin floor should have a broom finish or rougher. Finer finishes could prevent adequate bonding of the base grout to filter basin floor.

Any modifications that may have occurred during filter basin construction that will affect the underdrain or its rebar anchorage must be reviewed and approved by WesTech Engineering prior to installation.

The installing contractor must follow the recommended precautions found in this document to ensure that the underdrain system is clean and free of debris that could clog the underdrain system or otherwise impede backwash distribution.

Filter basin and flume shall be swept and vacuumed, to remove dirt and debris, prior to commencing underdrain placement. Backwash supply and air piping, if required, must be thoroughly cleaned.

There are three typical types of MULTIBLOCK installations, "Side Flume", "End Flume", and "Center Flume". "Side Flume" installations utilize a flume at the end of the lateral runs and wall sleeves or orifices to feed the laterals. "End Flume" and "Center Flume" installations use a flume located below the rows of laterals to distribute backwash water to each lateral. "End Flume" and "Center Flume" installations vary by location of distribution flume only, and therefore will be handled by the same instructions.

Caution: Filter basin floor should have a broom finish or rougher. Finer finishes could prevent adequate bonding of the base grout to filter basin floor.

For all types of installations, it is recommended to locate a grade line around the perimeter of the basin that will represent the top of the underdrain block (excluding media retaining cap). This grade line will need to be located 1'-1 1/4" vertically from the highest point in the filter floor. In addition to the horizontal grade line, vertical lines on lateral centerlines should be placed on the walls running perpendicular to the laterals to allow easier placement of the laterals.

For installations requiring airwash distribution below the underdrain or baffles, the airwash header and baffles must be installed prior to placing underdrain laterals. Please follow air distribution installation instructions found elsewhere in this manual.

Block Storage Before Installation

The underdrain blocks are manufactured of black High Density Polyethylene and therefore have protection from ultraviolet material degradation due to exposure to the sun. However, the plastic material is susceptible to deformation due to heating and cooling. Damage can occur if uninstalled blocks are exposed to elevated temperatures such as, but not limited to, those caused by prolonged exposure to the sun. Uninstalled blocks must be stored out of direct sunlight and should have additional protection if prolonged block surface temperatures could exceed 90 °F. The same is true for installed blocks that are exposed to the sun. These installations should be covered until operational.

Store shipped palletted blocks inside or under cover to prevent heat absorption. This will aid in lateral assembly as well as prevent potential damage.

Grout Specification

Grout used to install blocks shall be manufactured from materials as follows:

- Cement shall be standard brand Portland cement conforming to ASTM C150, Type II, for general use. Do not use non-shrink grout.
- Water shall be clean and clear potable water.
- Sand shall be clean and washed masonry sand that, when tested in accordance with ASTM D2419, the sand equivalency shall not be less than 90% for an average of three samples, or less than 85% for any individual sample. One hundred

percent of sand particles must pass a No. 4 sieve, and not more than 4% of the sand particles shall pass a No. 200 sieve.

- Chemical admixtures to prevent shrinkage may be required.
- The minimum compressive strength of the grout shall be 2300 psi (17240 kpa) after 30 days of curing.
- Typical grout shall be one part Portland cement to two parts sand properly mixed. Maximum cement to water ratio by weight shall be from 0.5 to 0.55 for the base grout and 0.61 to 0.67 for the fill grout. Consistency of the base grout should be suitable to support laterals without sinking.

Caution: Assembled laterals are manufactured of black High Density Polyethylene and therefore have protection from ultraviolet material degradation due to exposure to the sun. However, the plastic material is susceptible to deformation due to heating and cooling. Damage can occur if uninstalled laterals are exposed to elevated temperatures such as, but not limited to, those caused by prolonged exposure to the sun. Uninstalled laterals must be stored out of direct sunlight and should have additional protection if prolonged block surface temperatures could exceed 90 °F. The same is true for installed blocks that are exposed to the sun. These installations should be covered until operational.

Lateral Assembly

Laterals are created from a suitable amount of full blocks and the following (as required):

- Standard block
- Make-up end block
- Flume block (“End Flume” and “Center Flume” style only)
- End Caps
- Adhesive/Sealant

Fill groove in “groove” end of block with supplied sealant. See sealant placement detail.

Slide “tongue” end of single full block into the “groove” end of the started lateral assembly, until top and bottom locking mechanisms engage. Each tongue and groove joint and locking mechanism must be checked for complete assembly. Proper assembly with leak-free joints is the responsibility of the contractor.

Continue to add sealant and full blocks (as necessary). Care must be taken to locate flume block (when required) in position to straddle flume and air header riser. Finish lateral with make-up end block. When all required blocks are connected, apply a bead of sealant on the cut face of each free end of the lateral and install lateral end plug. See lateral end plug placement detail. If the blocks have a media retaining shield, the screws that hold it to the block will protrude through the block. These screws should either be cut off to allow for inserting the plug or backed partially out and reinstalled after the plug is positioned.

Laterals should be assembled completely and stacked in the filter basin prior to underdrain installation. Care should be taken when

moving assembled laterals to prevent locking mechanisms from disengaging. Support laterals every 6' to 9'.

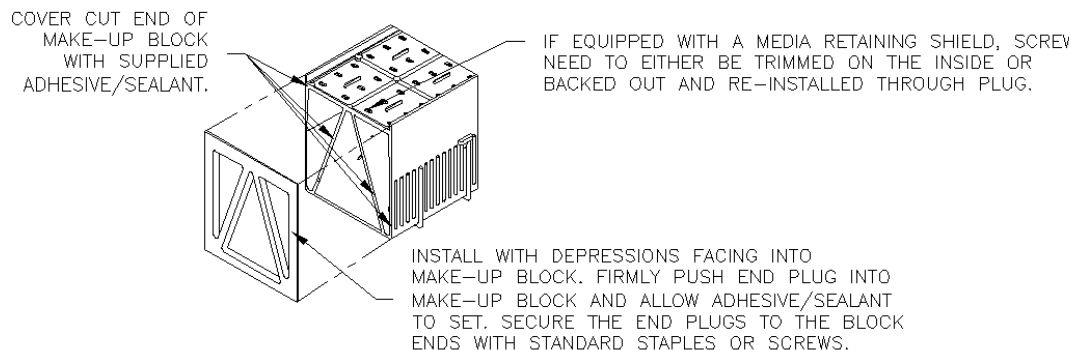


Figure 2.1: Lateral End Plug Placement Detail

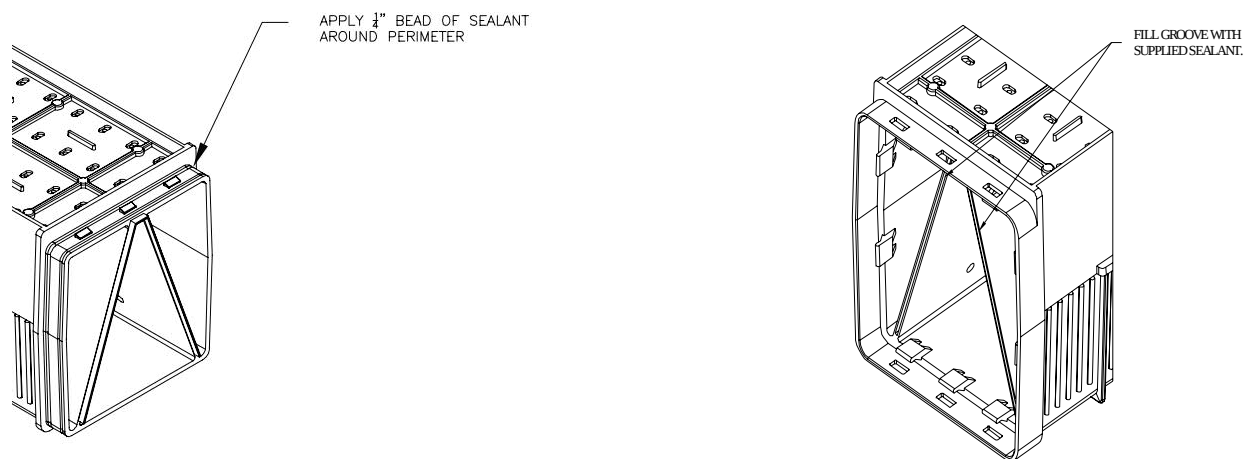


Figure 2.2: Sealant Placement Detail

General Procedures for Placing Laterals

Read the following directions carefully to ensure proper installation. Cleanliness of the underdrain is critical to final operation of the filter. Should the openings in the top of the block or media retaining shield become plugged with grout or grout enter the lateral passages, the filter will not backwash uniformly or at the proper rate.

Before placing any of the blocks, the laterals, the flume, and the floor slab of the filter shall be thoroughly and carefully checked and subsequently swept and washed to remove all dirt, dust, and debris of any nature. Thereafter, the floor slab and flume shall be maintained clean during the placing of the blocks.

Before proceeding in each filter, check the layout dimensions of the basin and inspect the floor for level and any low places. Check the flume dimensions to see that it is constructed to the dimensions shown on the drawings. Verify anchor rod locations are correct, when required.

Apply Conspec Strong Bond or similar bonding agent (not by WesTech Engineering) to the exposed concrete surfaces that will be in contact with the base grout immediately before grout is installed to ensure a good concrete bond. Blocks are to be set on 3/4" of grout that meets the requirements of section 3.

When setting laterals into the base grout, sufficient pressure must be applied to ensure proper bedding. After bedding the lateral it must be leveled. To prevent damage to plastic block, do not hit them directly with a hammer to level. Care must be taken not to slide laterals after bedding; this will cause improper grout consistency and could affect bonding and distribution.

Protection of the top of the laterals must be provided at all times during installation when pouring grout or using laterals already in place as a work surface, to ensure plugging does not occur. Time spent protecting the lateral surface can save significant amounts of clean-up time. Use 1/2" minimum plywood (or 5/8" minimum oriented strand board) on top of the laterals when the laterals are used as a work surface, to distribute loadings and prevent dislodging of the laterals from the base grout.

Placing Laterals – End or Center Flume Application

Layout flume rebar locations as shown on supplied drawings, and mark drilling locations. It is recommended to use a single block placed between each location to ensure spacing of rebar is correct, to prevent any interference. Once the layout of the rebar has been

established, drill holes and install rebar, securing with Hilti HIT adhesive system or approved anchor system.

Follow anchor system instructions for drilling, cleaning of holes, rebar end cutting, etc. in full detail. Typical installations require a 5/8" diameter drilled hole with a 4 1/2" minimum embedment of anchor.

(Adhesive for any anchors and rebar is not by WesTech Engineering.)

Once the rebar has been installed, the laterals can be placed. Spray exposed concrete surfaces with a suitable bonding agent, and place a 3/4" bed of grout the entire length of the filter cell at least as wide as a lateral starting at a side wall.

Trimming of the flume bridges nearest the side walls might be required to allow correct lateral spacing. Place the trimmed flume bridge into the base grout making sure to center it over the flume. The flume bridge should be submerged approximately 1/4"–1/2" into the base grout. Place the trimmed edge toward the wall. Seal the trimmed edge of the flume bridge along the wall with supplied sealant.

Flume bridges need to be supported during concrete pours to prevent poured concrete from moving the flume bridge and allowing concrete to flow into the flume. WesTech Engineering recommends supporting each flume bridge by drilling a hole in the top of the center stiffening rib and tying or wiring the flume bridge to the adjacent rebar.

Lift and lower the first lateral until it is bedded in the base concrete, making sure that the flume block is centered over the flume. Level the lateral within 3/16" by using previously scribed grade line. Care must be taken when lowering laterals onto the flume bridges as lateral ribs must fit into the indexes of the flume bridge to provide an adequate seal. Flume bridges must not be knocked out of place or concrete will flow into the flume when pouring the fill grout.

Once the first lateral is in place, the next flume bridge can be slid under the placed lateral and leveled so that the next lateral will sit on top of it and create a blockage for the fill grout. The flume bridges are designed to allow variable spacing of laterals and should be located so that both adjacent laterals sit properly on the flume bridge. Inspect the flume bridge for potential leak areas and seal with sealant as required. Alternatively, base grout may be manually placed along the joint where the flume bridge and blocks are in contact.

Continue to place all laterals as defined above. It is recommended to lay the last three rows of laterals together after the other laterals

Caution: Damage to the blocks can occur if base installed laterals are exposed to elevated temperatures such as, but not limited to, those caused by prolonged exposure to the sun. Base grout installed laterals must be protected from direct sunlight and should have additional protection if prolonged block surface temperatures could exceed 90 °F.

have had a chance to set up. This provides more room to work and eliminates the necessity of standing on a row just finished.

Completion of Installation

It is much easier to keep the blocks and shields clean than it is to clean them after installation. The small holes in the top of the blocks and shield openings must be kept open, and it is important that the blocks are not walked on until the grout has had time to set up, so as not to displace any of the blocks.

After the filter has had all laterals placed and the base grout has set-up overnight, the grout between the laterals can be placed. The base grout must be allowed to sufficiently set-up before completing the installation, to prevent dislodging of any laterals from the base grout.

Before placing the fill grout, the filter must be inspected for locations that could leak into the feed flume. Any such location should be sealed with sealant or other acceptable means and allowed to cure sufficiently before placing fill grout.

Once all potential leak locations have been addressed, apply Conspec Strong Bond or similar bonding agent (not by WesTech Engineering) to the exposed concrete surfaces that will be in contact with the fill grout immediately before grout is installed, to ensure a good concrete bond.

After the bonding agent has been applied, fill grout meeting section 3 can be poured or pumped into all spaces around and between the laterals. Full penetration of the volume down to the base grout is required. The underdrain should be filled to the top surface of the block (excluding media retaining cap when required).

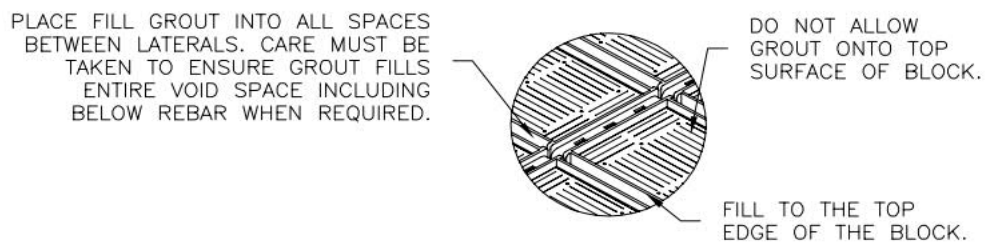


Figure 2.3: Grout Placement Around Blocks

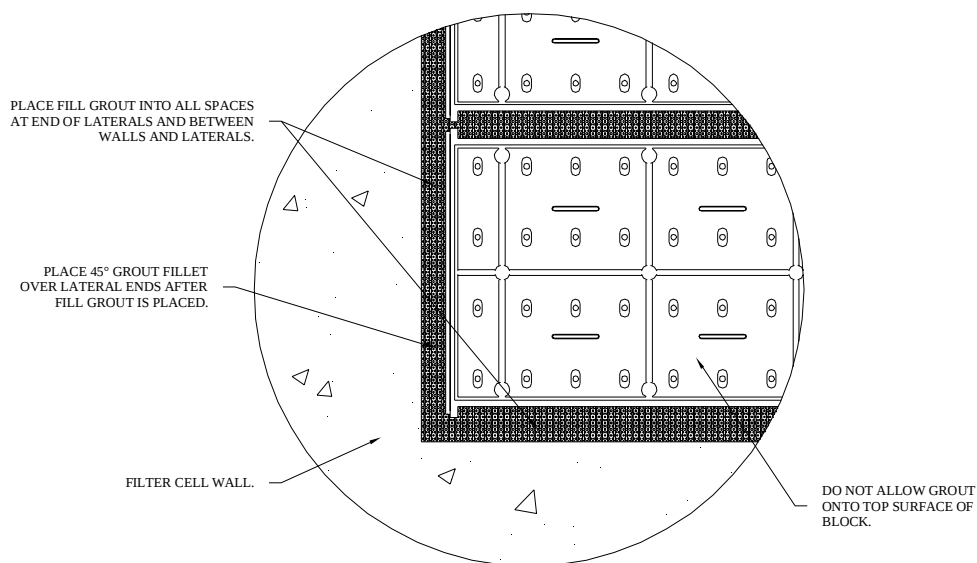


Figure 2.4: Grout Placement at Block Ends and Sides

Any spills should be cleaned up immediately to prevent plugging.

Several ways of doing the fill grout job have been successfully used on this type of underdrain installation.

- Use roofing paper (about 45 pounds) full length of a row of blocks. Lay the paper on the blocks up to the space to be grouted. Dump the grout on the paper and work it into the space between the rows and along the walls. In this way, you should be able to complete the job as you go. If too thin a grout is used, it may be necessary to go over the job to fill up or point up due to shrinkage.

- Another way is by taking a roll of lightweight roofing paper (15 pounds), cutting it into 10 1/2" wide strips, laying a strip over each row of block, and holding it in place with masking tape. The grout can be dumped on the roofing paper and troweled into the space between the rows of blocks. In this way, the grouting can be done without getting grout into the small holes on top of the blocks. This also keeps the blocks clean and saves a cleaning job.
- Use a "V" shaped funnel about three feet long with 1/2" openings along the bottom of the "V". Make the ends of wood and the sides of about 20 gauge galvanized steel. The narrow end of the "V" funnel is placed in the space between the rows to be grouted and the grout dumped into the funnel and worked down between the rows of blocks with a trowel until the grout is level. A plastic road warning cone with the tip cut off has been found to work for this arrangement.
- Another method is to use two pans made of 20 or 22 gauge galvanized steel, each pan being about 11" wide, 3–4 feet long, with one side turned up 2" and the other side turned down approximately 1/2". These pans lay on top of the blocks facing one another on adjacent rows so that the 1/2" turn downs are in the joint to be filled. The grout is then dumped on the pans and is easily worked into the space between the rows with a trowel. The pans slide along the top of the blocks and serve to keep the blocks clean.

Grout fill areas between laterals and along walls must be free of entrained air pockets that could lessen the integrity of the pour. These areas must be worked to remove air pockets, but care must be taken not to dislodge laterals.

Once the fill grout has been placed, a 45° grout fillet extending 1" to 2" onto the laterals must be added along the wall at each lateral end (over the lateral end plugs). Tape off the area on the block that will be covered by the grout fillet, prior to placing the grout, to prevent migration of grout inside the lateral. A grout fillet along the wall running parallel to the laterals is not required.

Warning: The underdrain has a maximum upward pressure of 850 PSF, not accounting for the weight of the media, and a downward pressure of 1,400 PSF plus the dead weight of the underdrain. Damage to underdrains caused by exceeding these pressures will not be covered by WesTech Engineering.

Final Check

After grout has fully cured in accordance with American Concrete Institute Specification “Standard Practice for Curing Concrete” #308, “Cold Weather Concreting” #306, or “Hot Weather Concreting” #305, the filter will be ready for media installation.

Before placing media remove all protective materials, then carefully inspect the underdrain making sure that all openings in the tops of the laterals are open, all water channels are clear, and all grout has been placed around the blocks.

The underdrain system shall be allowed to stand at least three days before turning on full backwash water pressure.

Sufficient water, however, may be put slowly through the underdrain system to make sure the system is properly sealed and all water passages open.

The filter is now ready for the placing of the support gravel (if required) and filter media. A plywood sheet over the entire bottom will prevent dirt from entering the lateral openings and will eliminate additional cleaning before placement of the media. Plywood will also protect the underdrain from damage caused by subsequent construction.

If at any time you need information in regards to the installation of WesTech MULTIBLOCK™ underdrain systems, please call our office at Ames, Iowa.

Caution: Never walk or place a ladder directly on the tops of the installed underdrains.

Warning: If the installed underdrain will not be placed on-line or have media placed within 3 days after installation, it must be protected from heating due to direct sunlight. Please see block storage section above.

ESSD Washtrough Installation

Refer to installation drawings and bills of materials included in this manual for additional installation information.

1. Locate the position for the washtrough hanger angle on the filter wall.

Anchor bolt holes can be drilled in advance, but anchors and hanger angle should not be set until trough is put into position.

2. Install the washtroughs in the filters. Block up the gullet end of the troughs. Install the washtrough hanger angles to the wall using concrete anchors, and assemble the washtrough hanger rods, washers, and nuts to the hanger angles and trough. Adjust the hanger rods until the trough edges are perfectly level both along the length of the edges and across the edges all along the washtrough. The edges must be held to elevation as shown on the installation drawing.
3. Provide temporary forms and fill wall cutout around the washtroughs at the gullet end with grout. Grout must be installed over trough to top of gullet wall to prevent trough end from floating out. The installation of the washtrough is now complete.

Note: Trough edges must be level and at the same elevation.

ESSD stainless steel washtroughs do not require painting, but carbon steel troughs may be finished painted at this time.

Media Installation

Your filter underdrain should now be ready for placement of the filter media. All equipment should be assembled except for possibly some external ancillary instruments.

The filter media should have been stored as described in the Storage and Handling section covering media handling at the beginning of these instructions.

Several workers will be required to install the media. Ladders, shovels, rakes, and scraps of plywood to stand on inside of the filter will be needed. A lift truck is almost essential.

Bulk media may be placed dry by using a chute or conveyor to discharge the materials into cell, from where they may be scattered with a hand trowel.

Bulk media may also be placed hydraulically by pump or ejector.

Workers should not stand or walk directly on the filter media. Place boards or plywood on the media that will sustain their weight without displacing the material.

Note: Before commencing media placement, refer to engineer's specifications for special requirements concerning media installation.

1. See reference drawing and packing list for media specifications, gradations, and depths. Be sure to set aside and store any spare media prior to placing media in filter cells.
2. Media shall be installed in accordance with ANSI/AWWA B100-01.
3. Vacuum clean all surfaces in contact with backwash water supply as directed by engineer's specifications and manufacturer's instructions. Be sure underdrain construction has been installed per Installation, Operation and Maintenance Manual prior to placing media.
4. Care must be taken to protect distribution baffles or strainers from damage when cleaning cells or placing media.
5. Clean each filter thoroughly before any filter media is placed within the filter.
6. Before any media is placed, mark a continuous level line on the inside of the filter to represent the top elevation of each layer of the filter media.
7. Divide filter media equally between the number of filters to be installed.
8. Place filter sand media within the filter cell first.

9. The top elevation of the Anthracite media layer can be checked by filling the filter with water to previously marked line. Screed each layer to a true level plane.
10. The top elevation of each layer should be equal to the finished elevation plus the depth of media required for skimming.
11. After each layer of media has been placed into the filter cell, slowly fill the filter by adding water up through the underdrain.
12. After the media is submerged, slowly backwash the filter.
13. After initial backwash, scrape the filter media as directed by the engineer.
14. The filter should be backwashed three times between additional scrapings if so required.
15. After final scraping add filter media as required to bring the top surface of the media to the correct elevation.
16. Before filter is put into service, disinfect filter as required by engineer.

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Section Three: Start-up and Operation

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Startup – Filter Plant

After the plant has been completely installed, painted and sterilized, it is ready for startup.

Make a final check of the following:

1. Have all motors, pumps, compressors, speed reducers, etc., been serviced per manufacturer's instructions?
2. Has a careful study been made of operation instructions to prevent error in plant startup?
3. Have all meters and gauges been adjusted and has air been bled from all lines?
4. Have all valve air lines been checked and cleared of debris before connection to valves?
5. Has electrician carefully checked electrical wiring and control for proper operation?
6. Have all parts of the new installation been adequately sterilized? Sterilization of equipment is not by WesTech.
7. Initial filling of the filter units should take place at no more than 1/4 to 1/3 of the filter flow rate until the water level is above the media in the cells. Avoid disturbing the media surface by keeping the flow rate low until the media is submerged.
8. After plant has been placed in operation, operator should observe operation for a period of time to make sure all equipment is functioning properly.

Startup – Gravity Filter

1. Fill filter with water from the bottom slowly with the backwash supply up to the washtrough level.
2. Check to make sure all connections are tight.
3. Filter media should be backwashed prior to sterilization. Refer to instructions for backwashing filter.
4. Backwash each filter cell slowly for 5 minutes.
5. Backwash each filter cell at full rate for 10 minutes.
6. Close the main effluent, backwash waste and drain valves. Open all filter inlet valves.
7. The filter should be sterilized before placing the unit into service. Follow AWWA Section 4.4.4.1, state regulations or contract specifications for sterilization.

It is recommended that the filter be sterilized using 50 ppm chlorine using sodium hypochlorite solution (liquid bleach) or dry calcium hypochlorite (HTH) for at least 12 hours if no other procedures are available.

8. The filter can be backwashed again to be free of the chlorine solution.
9. The filter is ready for service.

Startup – Setting Backwash Rate of Flow

Backwash water flow rate is controlled by the elevation of the effluent weir and supplement backwash pump flow (if required).

The design backwash rate listed is based on a temperature of 25 degrees C. The actual backwash water rate must be adjusted 2% up or down for each degree Celsius difference above or below design temperature; i.e., above 25 °C increase by 2%, below 25 °C decrease by 2%.

Backwash Temperature Adjustment Chart

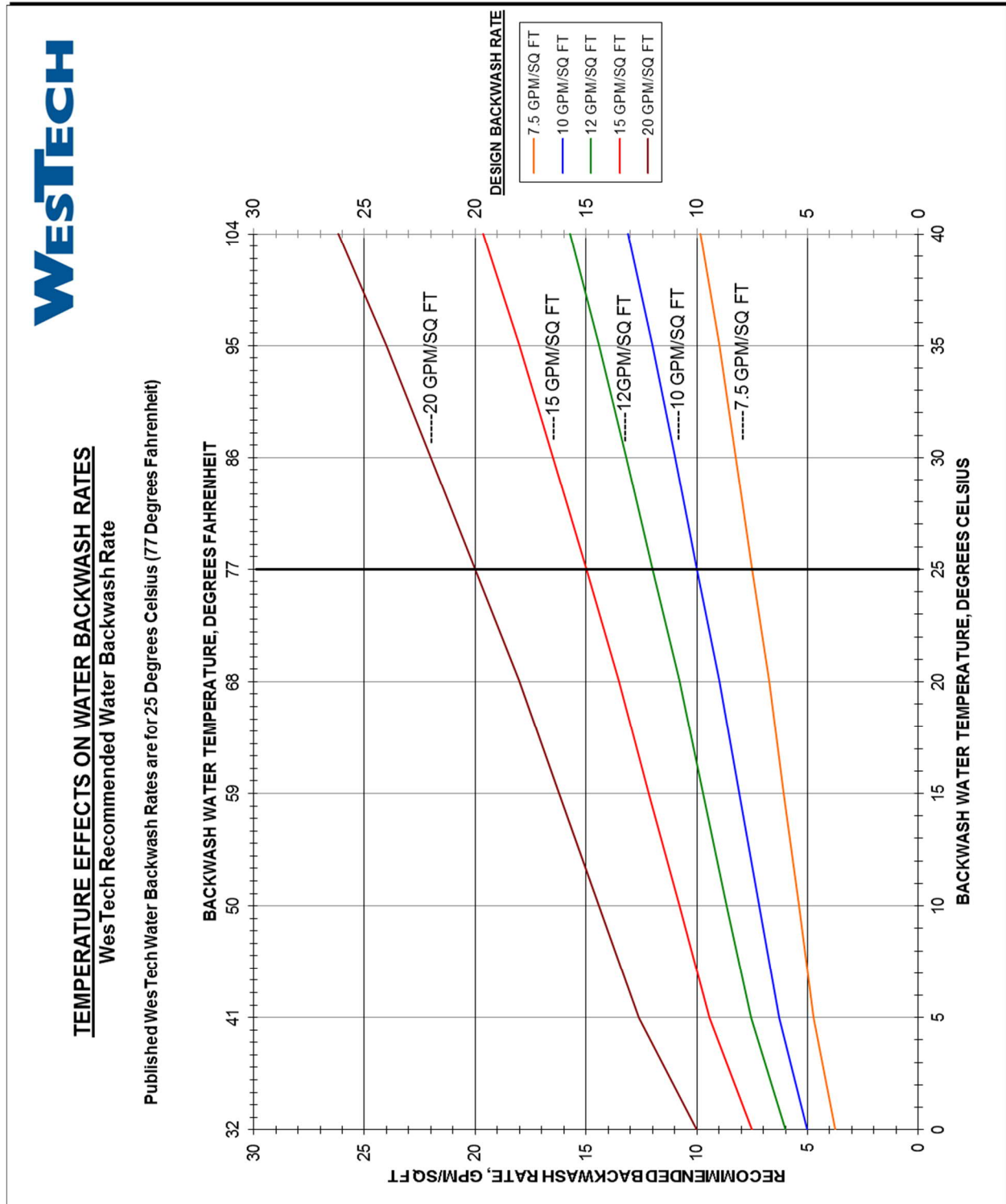


Figure 3.1: Temperature Correction Chart

Operation – Gravity Filter

Purpose of the Filter

The principal object of the filter plant is the removal of turbidity, iron, and manganese from the raw water before it enters the mains.

Refer to the pertinent data section of this manual for design operating conditions. The treated water should have an iron and manganese content of not more than 0.3 parts per million.

Purpose of Backwashing the Filter

During the treating process the metallic oxides and turbidity taken from the raw water accumulate on top of the filter media in the filter. This material must be removed by periodically flushing out, or backwashing, following the instructions given in this booklet.

Correct backwashing is the most important part of the operation of the filter plant. When the filter is washed at the proper rate, the media bed is lifted and the grains rub together. If the rate is too great, media will be lost from the filter. If the rate is too low, the bed will not be completely cleansed.

Frequency of Backwashing the Filter

The length of filtering cycle is somewhat dependent upon the load being handled by the plant. Adequate backwashing is essential to the successful operation of this plant.

As the loss of head builds up through the filter, a greater head of water is required to maintain the desired flow rate. Thus the water level in each cell rises until a set high level is reached.

It is good practice to periodically backwash the filter at least every ten days, however, even though a maximum loss of head may not have developed.

Proper Procedure for Backwashing the Filter

Air Followed by Water Backwash Procedure

1. Close the influent valve, and allow the filter to operate until the water level is approximately 6" above the media. If necessary, open the Filter to Waste valve to do so.
2. Close the effluent valve (or Filter to Waste valve), and open the backwash waste valve.
3. Start airwash blower.

Note: Discharge of initial backwash water may be clean until the freeboard volume above the filter media has been displaced by the actual backwash water.

4. Slowly open the airwash supply valve until the design airwash rate is achieved. Scour the filter media for two to five minutes at the design rate.
5. Turn on the backwash supply pump.
6. Gradually open the backwash supply valve until the design proper backwash rate is achieved. Let filter backwash until the water is near the bottom of the backwash collection trough. Then close the air supply valve and turn off the airwash blower.
7. Allow the water only backwash to continue until the water entering the trough is a light straw color. Backwash lengths beyond which the waste discharge has reached a light straw color are not necessary.
8. Slowly close backwash supply valve, and turn off the backwash supply pump.
9. Close backwash waste valve.
10. Open influent valve.
11. Filter to waste, if applicable, then open effluent valve to return to service.

Operation – Filters with Media Retaining Underdrains

As a manufacturer of filter underdrain components, we advise all engineers and contractors to review each installation in advance of construction for filter backwash supply water contamination sources. Possible sources of contamination to filter backwash supply would include, but not be limited to the following:

1. Filter bypass water should not discharge into the filter underdrain chamber, filter effluent weir tank, or backwash supply tank.
2. Open effluent weir tanks or backwash supply tanks provide no means of preventing contamination by acts of nature or human negligence. These tanks should be covered.
3. If a positive backwash supply pressure relief standpipe is provided, it must be protected from possible entry of debris. If a screen cover is provided, it should not alter the design hydraulics of the pressure relief device.
4. Filters that are designed for airwash, either staggered or simultaneous, should include pressure relief valve on the discharge line of the airwash blower. The relief valve should be set to relieve the blower design capacity at a pressure less than the underdrain design pressure.
5. All valves that connect to the filter underdrain chamber, such as the effluent, backwash supply, and airwash supply, should be equipped with speed control or manual activators, which will not allow sudden pressure surges into the underdrain chamber.

Since the filter must be backwashed with filtered water only, it is advisable to fill the backwash supply tank (or clearwell, etc.) with potable water from the city water supply at time of start-up. This water should be used to backwash the filters before they are placed in initial service.

If for any reason the filters are bypassed and raw water or sewage is allowed to come in contact with the backwash supply piping or tankage, all equipment must be drained and re-cleaned before the filters are returned to service.

On waste water treatment filters that are equipped with media retaining nozzles, it should be a normal operation to continuously pre-chlorinate to help reduce biological growth in the filter media and underdrain collection chamber. If this is not possible, then at least once a month the filter should be shock chlorinated prior to backwash. This monthly cycle will help control biological growth and

Warning: Media retaining underdrains, furnished by WesTech, are designed for use in municipal and industrial water and waste water treatment filters. All filters utilizing these underdrains will require backwashing with filtered water only. Should any filter equipped with our media retaining underdrains be backwashed with unfiltered, dirty, debris laden backwash supply water, the underdrain will become plugged. Underdrain failure is possible unless the underdrain is maintained in a clean, free flow state.

prevent premature fouling of the media, media retaining nozzle, and its air control orifices if so equipped.

WesTech liability is limited exclusively to the replacement of defective materials, F.O.B. Ames, Iowa, as stated in our Standard Guarantee and Warranties. This warranty expressly excludes improper installation or operation and any problems or failures caused by parts, materials, or labor furnished and installed by others.

Operation – Gravity Filter Rise Rate Measurement

Use the following table to estimate fluid flow rate by measuring vertical rise.

GPM/SQ FT	Vertical Rise Inches/Minute
1	1.6
2	3.2
3	4.8
4	6.4
5	8.0
6	9.6
7	11.2
8	12.8
9	14.4
10	16.0
11	17.6
12	19.3
13	20.9
14	22.5
15	24.1
16	25.7
17	27.3
18	28.9
19	30.5
20	32.1
21	33.7
22	35.3
23	36.9

24	38.5
25	40.1

Figure 3.2: Rise Rate Table

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Section Four: Maintenance and Parts

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Equipment Maintenance

Recommended Spare Parts

None.

Recommended Maintenance

This gravity filter equipment produced by WesTech Engineering, Inc. is manufactured of corrosion resistant materials or provided with corrosion resistant coatings. Therefore, touch-up painting is unnecessary. Very little other maintenance is required other than periodic visual checks of the equipment to be sure nothing looks out of the ordinary.

Lubrication Instructions

No lubrication is required.

Equipment Maintenance Summary Sheet

See next page.

GLASGOW WATER SYSTEM IMPROVEMENTS PROJECT

EQUIPMENT MAINTENANCE SUMMARY SHEET

Equipment: Filter Underdrain System				Spec. Section: 11380			
Location: Filtration Location							
Mfr.: WesTech Engineering				Phone: 515-268-8400			
Address: 600 Arrasmith Trail				Ames, IA 50010			
Area Rep: Goble Sampson Associates				Phone: 303-770-6418			
Address: 6355 Ward Rd, Suite 200				Arvada, CO 80004			
ELECTRICAL NAMEPLATE DATA							
Serial No.:		ID No.:		Model No.:		Fram No.:	
Mfr. No.:	HP:	V:	Amp:	HZ:	Phase:	RPM:	SF: Duty:
Cat. No.:	Code:	Inst. Cl.:	Design:	Type:	°C Amp:	NEMA des.:	Rating: Ratio:
Class:		Group:		Shaft End Brg:		Opposite End Brg:	
Miscellaneous Nameplate Data:							
Recommended Spare Parts:							
Lubricants: Summer Winter							
MECHANICAL EQUIPMENT NAMEPLATE DATA							
Serial No.:		ID No.:		Model No.:		Fram No.:	
Mfr. No.:		HP:	RPM:	Capacity:	Size:	Code:	Case No.:
Cat.:		TDH:	Imp Sz:	Ratio:	Max RPM:	Min RPM:	Lube Inst.:
Belt No.:		CFM:	Form:	Press:	Const.	Assy No.:	Order No.:
Recommended Spare Parts:							
None							
N/A							
Lubricants: Summer Winter							

GLASGOW WATER SYSTEM IMPROVEMENTS PROJECT

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Section Five: Enclosures

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Procedure for Ordering Spare or Replacement Parts

Spare or replacement parts may be ordered from the Aftermarket Sales Department at:

WesTech Engineering, Inc.
3665 South West Temple
Salt Lake City, Utah 84115
Phone: (801) 265.1000
Fax: (801) 265.1080
24-hour service/emergency:
(801) 265.1000
Email: PARTS@westech-inc.com
Web: www.westech-inc.com

If you would like to talk directly to an Aftermarket Sales representative during normal business hours (8:00 am to 4:30 pm MST), dial (801) 265.1000 and ask for the Aftermarket Sales Department. You may fax your order to (801) 265.1080.

To use the 24-hour service/emergency line after hours (4:30 pm to 8:00 am), dial (801) 265.1000. Please indicate to the Answering Service Operator whether your facility is Water, Waste Water or Industrial. They will inform you that a WesTech Representative will call and assist you with your problem.

If you would like to e-mail a spare parts order, simply e-mail your request to us at PARTS@westech-inc.com, and a WesTech representative will process your order and follow up with an Order Acknowledgment.

Spare parts may also be requested directly from our web page www.westech-inc.com. Simply go to the web page, click on Parts & Service. If you know the part number and job information you need, you can input it directly. A WesTech Representative will process your request and follow up with a purchase quotation or a return phone call, to confirm that your request has been received.

For convenience, a "Recommended Spare Parts List" is provided in this manual. This is a guide for the appropriate level of spares to keep on hand, minimizing lost time due to unscheduled breakdowns. Each item listed in the Recommended Spare Parts List is identified within one of the following categories:

- Normal maintenance and wear items.
- Long Lead items (minimum downtime).

Should you require further assistance in determining which spare parts are appropriate for your particular situation, please contact WesTech's Aftermarket Sales Department.

To avoid unnecessary delays in obtaining the correct spare or replacement parts for your equipment, be sure to give the following information with each order.

1. Identify equipment using the WesTech Job number. Your equipment is identified as follows:
WesTech Job Number: 23711B
WesTech Model Number: GFPB20
2. Identify the part by name, and give the number of the drawing on which this part or assembly appears.
3. Identify the part number.
4. Identify the size, and include all pertinent dimensions (such as diameter, length, thickness, bore, pitch, etc.) whenever possible.
5. If parts being ordered are electrical in nature, give all pertinent data such as voltage, amperage, wattage, cycles, speed, power factor, or other information given on the parts nameplate or included in the parts brochure.
6. Submit your written purchase order or request for a quotation, both signing and printing your full name so that WesTech will know whom to contact should further clarification of the inquiry be necessary. All verbal orders must be verified in writing.
7. Give a return address and a shipping address.
8. Give a preferred method of shipping: i.e., UPS, truck freight, rail freight, air express, etc.
9. Indicate the quantity desired.
10. Provide instructions for proper invoicing.
11. All spare or repair parts orders are subject to a \$100.00 minimum order charge.

Troubleshooting Guide

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Indicators or Observations	Probable Cause	Solutions
Effluent turbidity too high.	Filter needs backwashing. Inadequate upstream pretreatment.	Backwash filter. Run jar tests to determine and correct pretreatment. Add polymer if required to help filterability of turbidity.
High water level in filter.	Filter needs backwashing. Filter inlet valves not even. Filter effluent valve not opening fully.	Backwash filter. Check inlet valve elevations. Troubleshoot effluent valve and open fully.
Initial head loss greater than normal (1–2 ft.) following backwash.	Insufficient backwash time to thoroughly clean the filter media. Inoperative air scouring system.	Increase the settings on the backwash timer to provide longer backwash periods. Repair air scouring system.
Percentage of backwash water used exceeds 5% of forward flow.	Solids carryover to filter basin is too high. Filter aid dosages too high. Airwash system not working. Waterwash times are too long.	Provide better treatment in settling tanks by improving solids settling characteristics. Reduce filter aid dosage. Repair airwash system. Reduce length of backwash cycle.
Clogging of filter surface indicated by very rapid increase in head loss after backwash.	Inadequate prior clarification for filters. Excessive filter aid dosages in dual or mixed-media filters. Waterwash times are too short.	Improve pretreatment. Reduce or eliminate filter aid dosage to allow particles to penetrate deeper into the bed. Provide adequate backwashing.

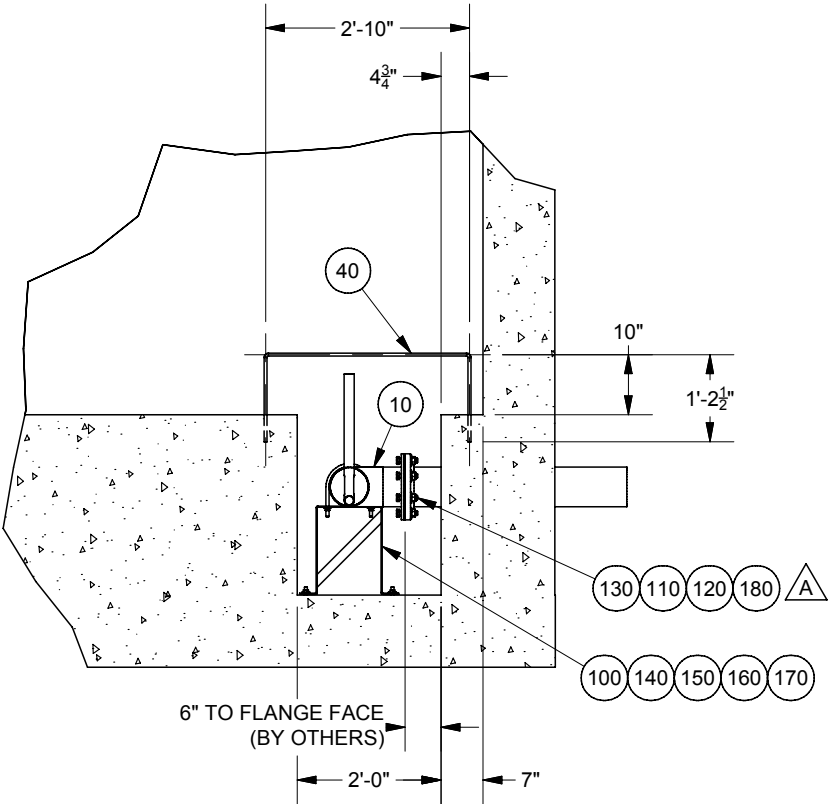
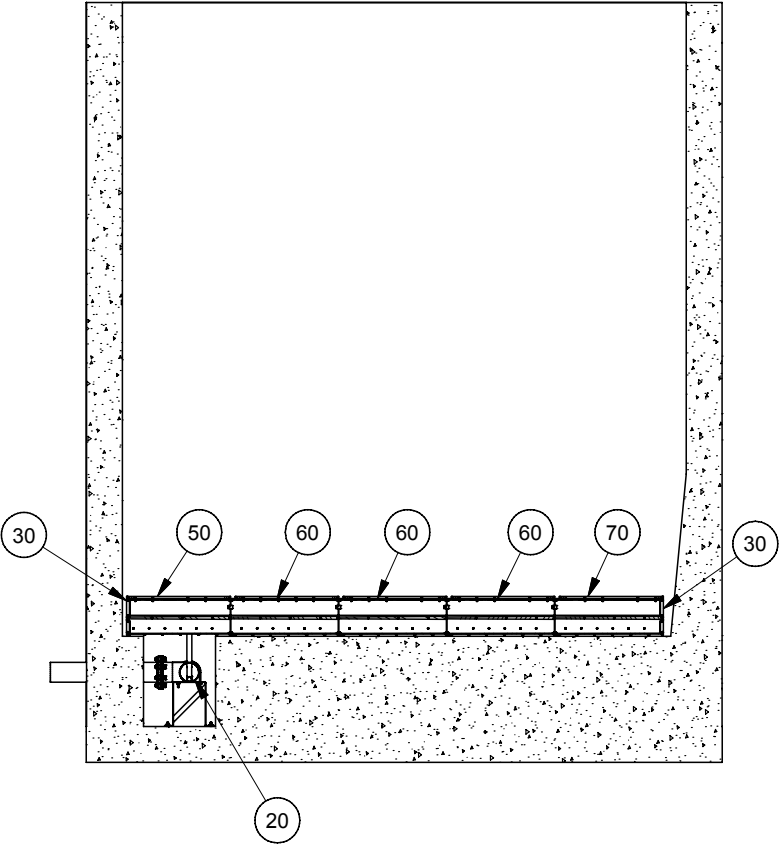
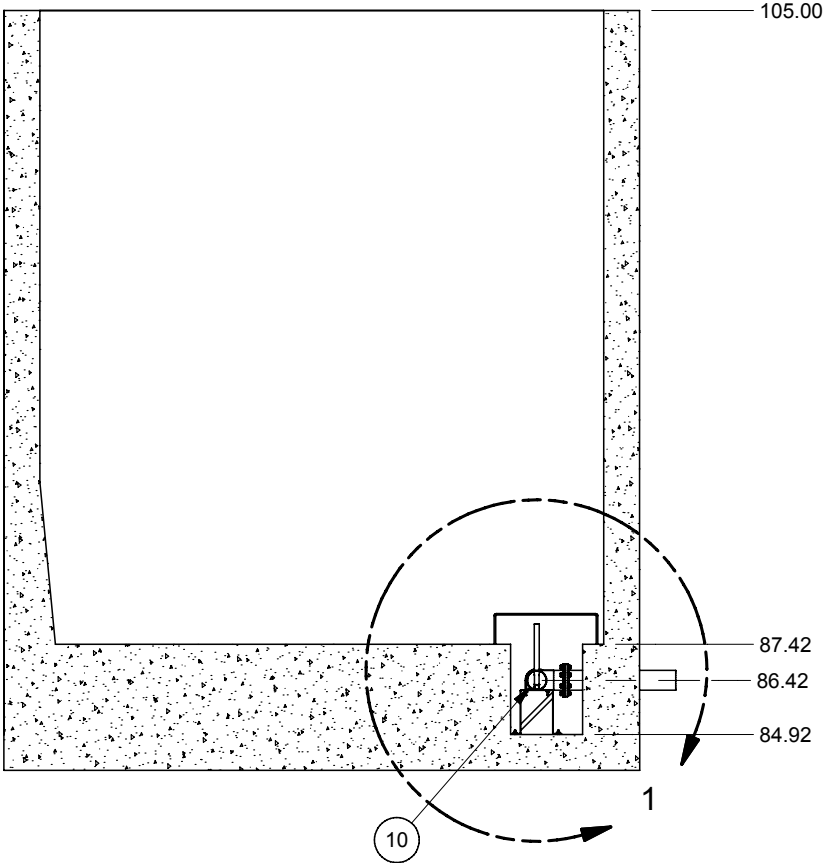
Indicators or Observations	Probable Cause	Solutions
Short filter runs.	Solids carryover to filter basin is too high.	Provide better treatment in settling tanks by improving solids settling characteristics.
	Filter aid dosages too high.	Reduce filter aid dosage.
	Insufficient backwash time to thoroughly clean the filter media.	Increase the settings on the backwash timer to provide longer backwash periods.
Filter effluent turbidity increases suddenly but filter head loss is low.	Inadequate dosage of filter aid.	Increase dosage.
	Pretreatment coagulant feed system malfunction.	Repair feeders.
	Change in coagulant demand.	Adjust coagulant dosage.
Mud ball formation in media.	Inadequate airwash.	Increase airwash time.
	Low backwash flow rate.	Increase backwash flow rate.
Loss of media during backwashing.	Excessive flows used for backwashing.	Reduce rate of backwash flow.
	Water level too close to washtrough lip during airwash or excessive airwash rate.	Check freeboard drain assemblies for premature siphon breaking.
	Air bubbles attaching to coal causing it to float.	Reduce airwash rate and increase time of water only backwash.
Difficult to clean filter adequately in warm weather at normal backwash rates.	Decreased viscosity of backwash water due to higher temperatures.	Increase backwash rate until desired bed expansion during backwash is achieved.

Indicators or Observations	Probable Cause	Solutions
Air binding in media causing head loss to increase prematurely.	Filter influent containing dissolved oxygen at or near saturation levels being subjected to less than atmospheric pressure in filter.	Provide more frequent backwashing to prevent bubbles from accumulating as quickly.
	Inadequate water only wash after airwash.	Increase length of water only backwash.
Valve does not operate when signaled.	No power to valve.	Reset breaker.
	Other problem in valve operator or controls provided.	Refer to O&M manual for valves.
Airwash does not proceed when water level reaches low float level during backwash.	Level sensor is malfunctioning.	Check for signal on level sensor.
	Level in filter not reaching preset point for airwash to proceed.	Be sure inlet valve is closed and either effluent or waste valve is open. Check freeboard drain if equipped.

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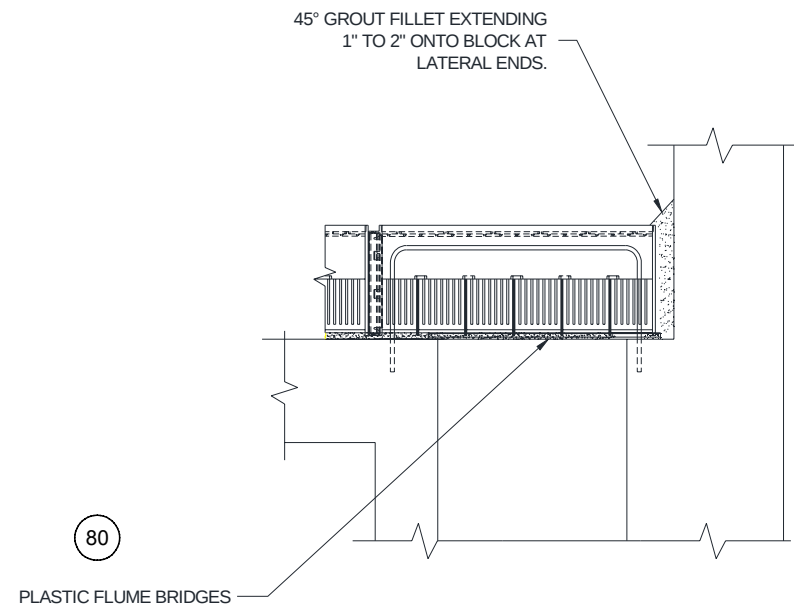
WesTech Drawings

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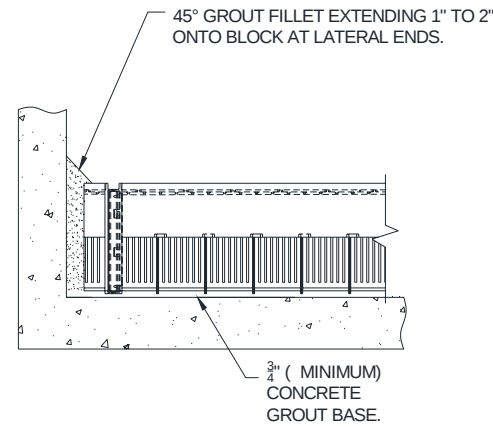


DETAIL 1

Westech				
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TITLE UNDERDRAIN BASIN LAYOUT				
DESIGNER	CHECKER	APPROVER	DATE	
RA23	BR63	BR63	2019-01-09	
DOCUMENT NUMBER			SHEET	REV
23711B-2001			2 OF 3	A

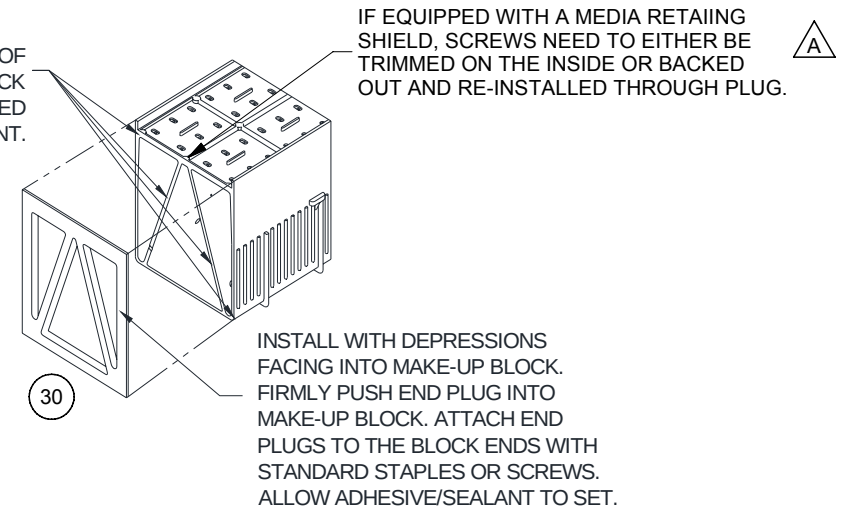


BOTTOM END FLUME DETAIL

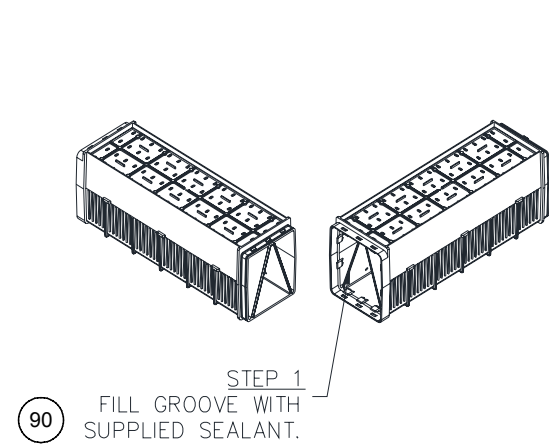


LATERAL END DETAIL

COVER CUT END OF MAKE-UP BLOCK WITH SUPPLIED ADHESIVE/SEALANT.



LATERAL END PLUG PLACEMENT DETAIL

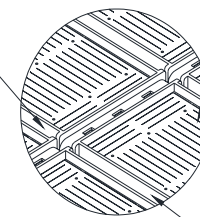


LATERAL ASSEMBLY DETAIL

STEP 2
SLIDE "GROOVE" END OF SINGLE BLOCK OVER THE "TONGUE" END OF THE LATERAL ASSEMBLY. SLIDE SINGLE BLOCK UNTIL ALL LOCKING MECHANISMS ENGAGE.

STEP 3
CONTINUE ADDING FULL BLOCKS (AS NECESSARY) AND MAKE-UP BLOCKS USING STEPS 1-3. AFTER ADDING THE END BLOCKS TO THE LATERAL ASSEMBLY, APPLY A BEAD OF SEALANT ON THE CUT FACE OF EACH FREE END OF THE LATERAL ASSEMBLY AND INSTALL AN END CAP IN EACH END.

PLACE FILL GROUT INTO ALL SPACES BETWEEN LATERALS. CARE MUST BE TAKEN TO ENSURE GROUT FILLS ENTIRE VOID SPACE INCLUDING BELOW REBAR WHEN REQUIRED.

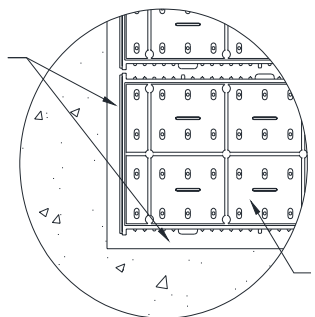


GROUT PLACEMENT DETAIL #1

DO NOT ALLOW GROUT ONTO TOP SURFACE OF BLOCK.

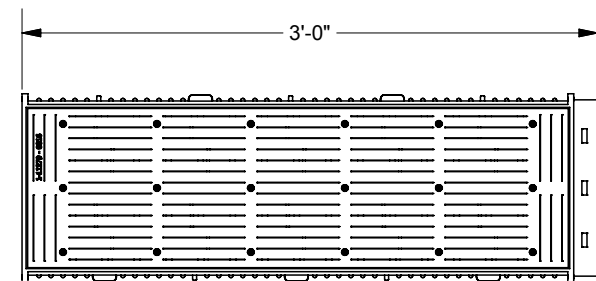
FILL TO THE TOP EDGE OF THE BLOCK.

PLACE FILL GROUT INTO ALL SPACES AT END OF LATERALS AND BETWEEN WALLS AND LATERALS.

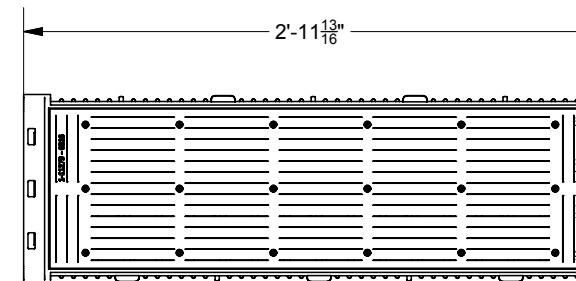


GROUT PLACEMENT DETAIL #2

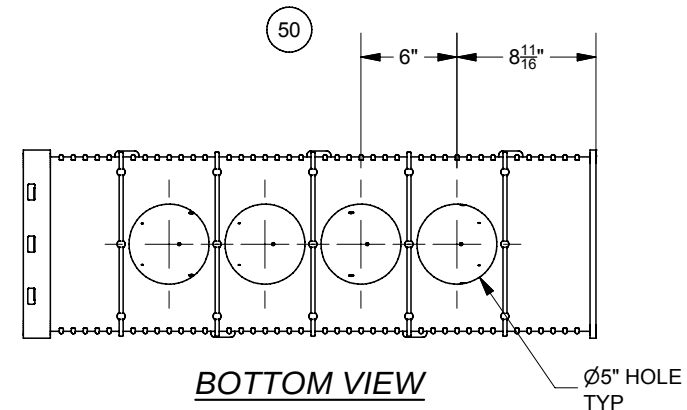
DO NOT ALLOW GROUT ONTO TOP SURFACE OF BLOCK.



MAKE-UP BLOCK #2



FLUME BLOCK



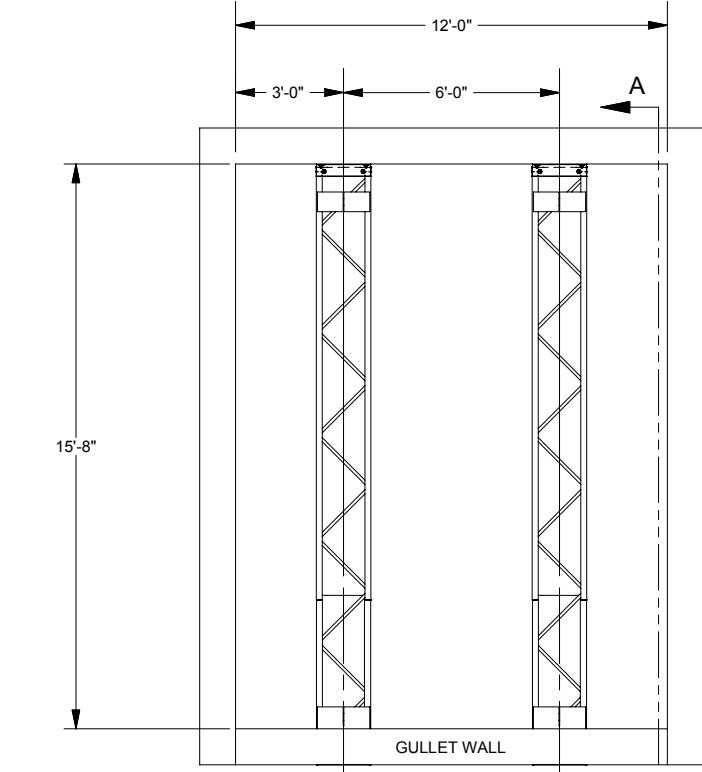
BOTTOM VIEW

Westech

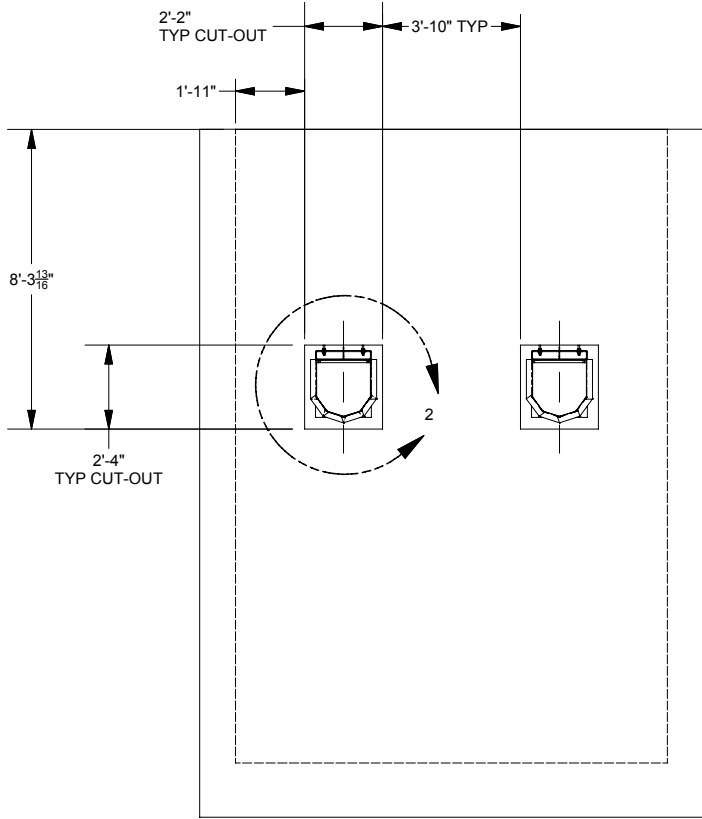
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TITLE **UNDERDRAIN BASIN LAYOUT**

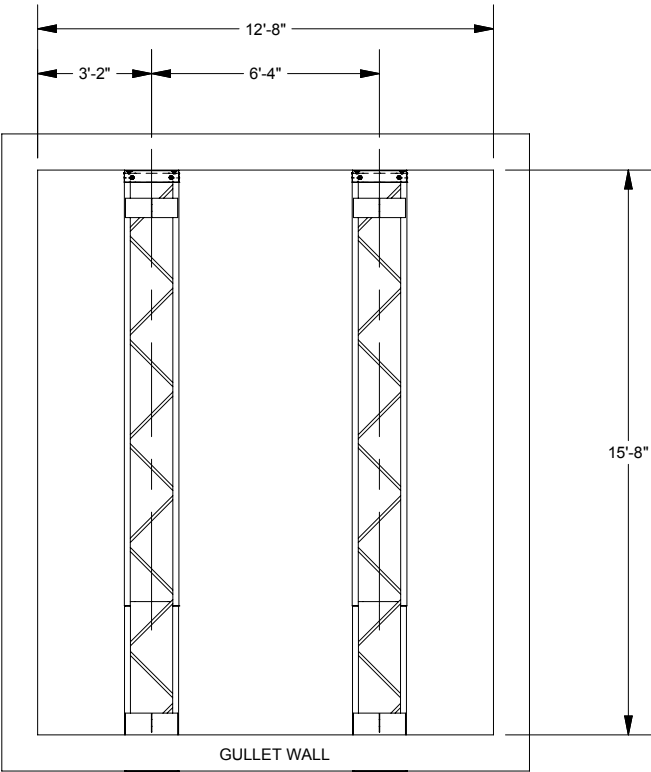
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			REV
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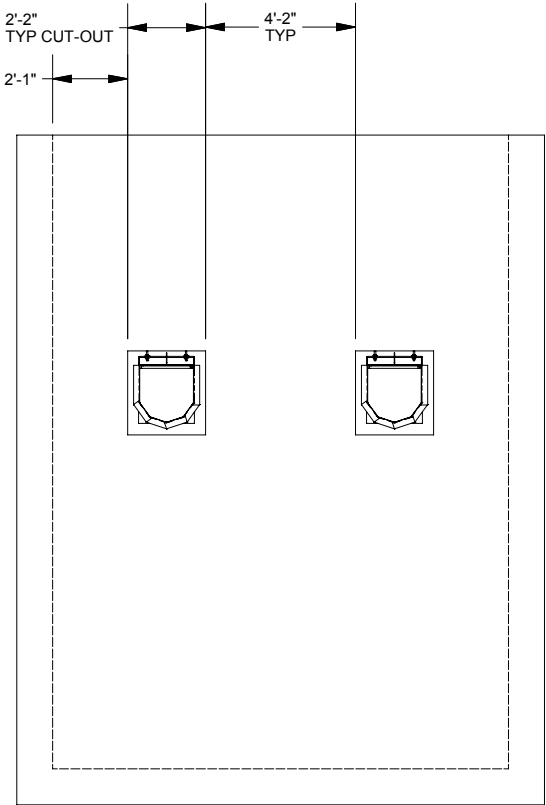
PLAN
FILTERS 2 & 4



ELEVATION

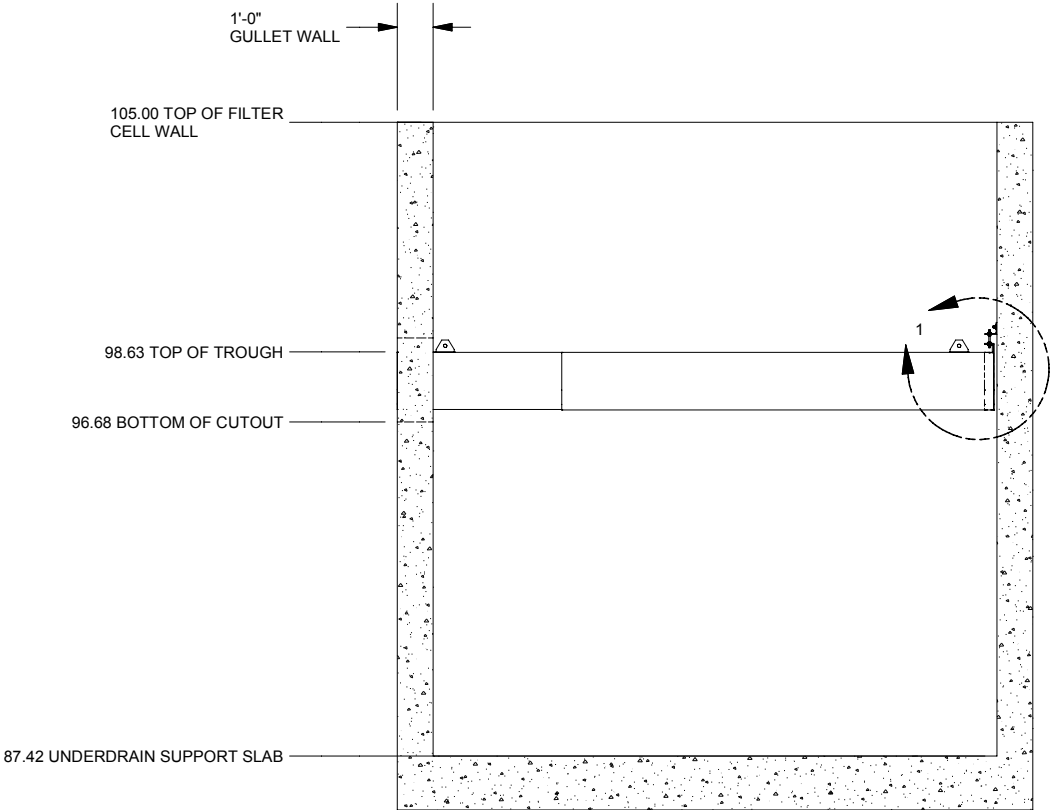


PLAN
FILTERS 1 & 3



ELEVATION

BILL OF MATERIAL							
PIECE	UNIT QTY	PART NO	DESCRIPTION	MATERIAL	LENGTH	WIDTH	TOTAL WT, LB
10	2	23711B-2017	WASHTROUGH FABRICATION (PLAIN)				519.0
20	2	23711B-2016	WASHTROUGH HANGER ANGLE				20.2
30	4	2-8903	ANCHOR, WEDGE, 0.625-11UNC x 4.75	304			1.8
40	16	2-5405	WSHR, FLAT, LARGE OD, 0.5	304			0.0
50	16	2-5890	NUT, HEX, 0.5-13UNC	304			0.6
60	4	2-7584	STUD, FULL THD, 0.5-13UNC x 6	304			4.0



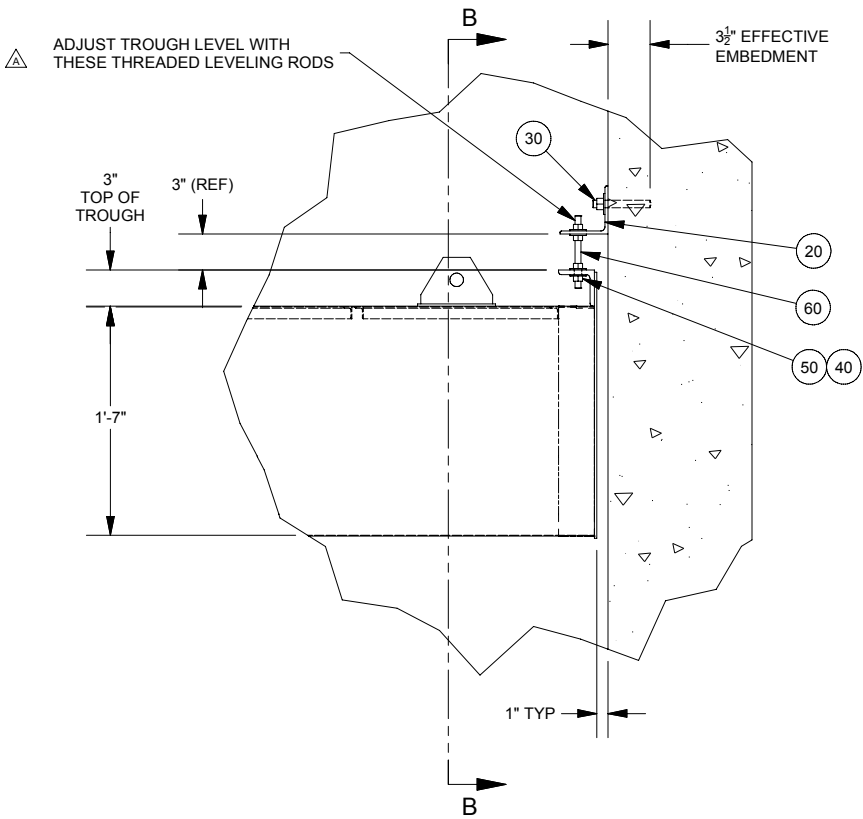
SECTION A-A

NOTES:

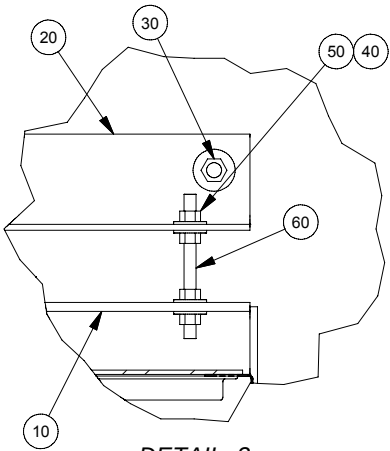
- 1.) FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.
- 2.) WASHTROUGHS FOR TWO CELLS SHOWN. WASHTROUGHS PROVIDED FOR FOUR CELLS.
- 3.) CONCRETE BASIN, GROUT, AND WASHTROUGH INSTALLATION ARE BY OTHERS.
- 4.) WASHTROUGH SHOULD BE LEVELED PER INSTALLATION INSTRUCTIONS PRIOR TO FINAL GROUTING INTO GULLET WALL.
- 5.) DIMENSIONS SHOWN IN PARENTHESES ARE CONSIDERED REFERENCE DIMENSIONS WHICH MAY VARY DURING INSTALLATION TO PROVIDE A LEVEL WASHTROUGH.
- 6.) LOCATE HANGER ANGLE WITH SHOP MARKING TOWARDS WALL.

A	ADDED NOTE FOR LEVELING TROUGHS	---	BR63	BR63	2019-02-12	23711B-2001
REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE	REFERENCE DOCUMENTS

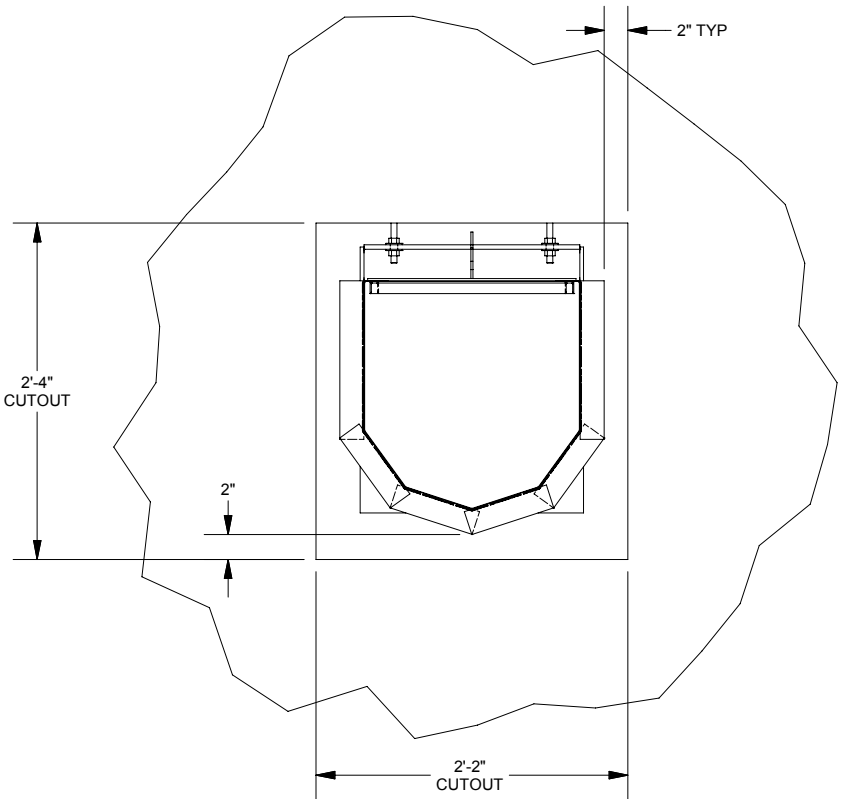
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TITLE WASHTROUGH COMPONENTS (PLAIN) ESSD WASHTROUGH COMPONENTS			
DESIGNER	CHECKER	APPROVER	DATE
RA23	BR63	BR63	2019-01-09
DOCUMENT NUMBER			SHEET
23711B-2003			1 OF 2
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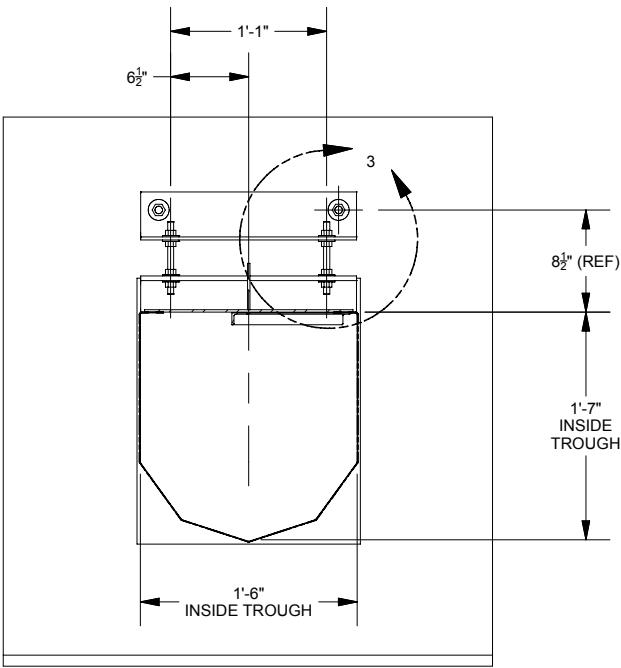
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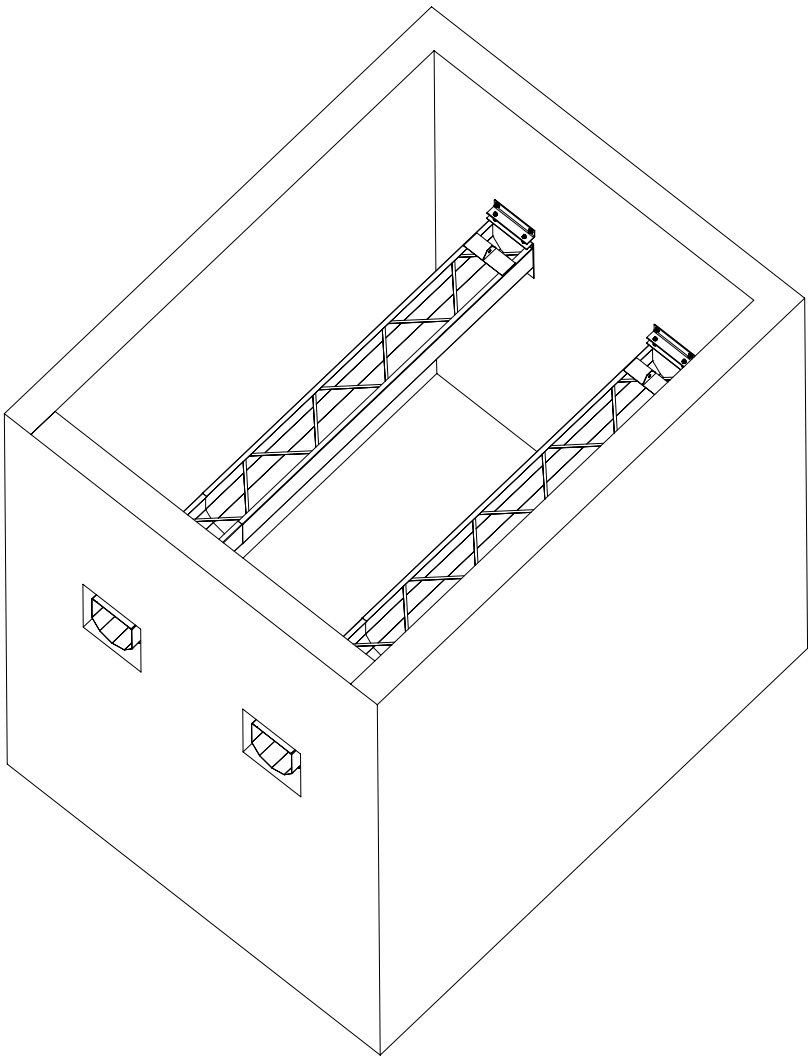
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DETAIL 2



SECTION B-B



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DESIGNER	CHECKER	APPROVER	DATE	
RA23	BR63	BR63	2019-01-09	
DOCUMENT NUMBER			SHEET	REV
23711B-2003			2 OF 2	A

CATALOG & BULLETIN INFORMATION

MEDIA COMPONENTS

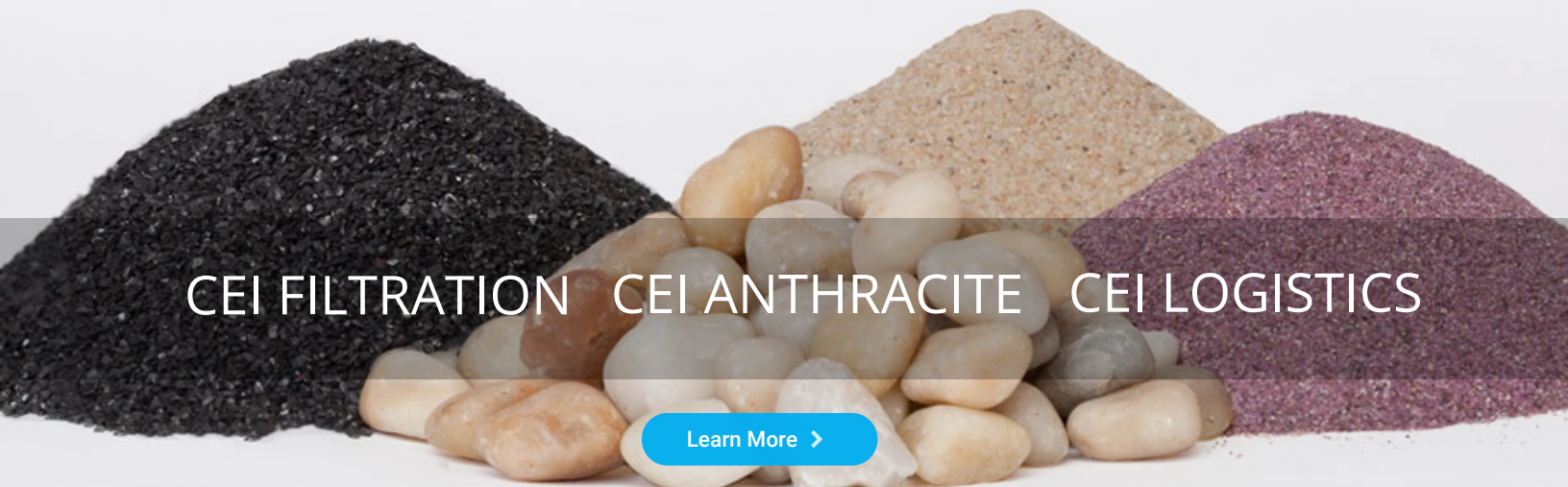
Sand

Location: Bottom Layer of Gravity Filter
 Function: Filtering media
 WesTech PN: 2-4849
 Material: Silica Sand
 Size: 0.45-0.55 mm, UC 1.5 Max
 Quantity: 198 ft³ Cubic Feet per Filter Cell (Includes 10% Extra)
 792 ft³ Cubic Feet Total

Anthracite

Location: Top Layer of Gravity Filter
 Function: Filtering media
 WesTech PN: 2-4830
 Material: Anthracite
 Size: 0.95-1.05 mm, UC 1.5 Max
 Quantity: 311 ft³ Cubic Feet per Filter Cell (Includes 15% Extra)
 1244 ft³ Cubic Feet Total

A	UPDATED TO SIEVE ANALYSIS THAT INCLUDE MOHS HARDNESS DATA; ADDED AWWA & NSF COMPLIANCE LETTER			BR63	2019/03/27
REV	REVISION DESCRIPTION		ECN	DESIGNER	APPROVER
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DESIGNER	EH00	TITLE CATALOG & BULLETIN INFORMATION MEDIA COMPONENTS			
CHECKER	BR63				
APPROVER	BR63	CLIENT GLASGOW WATER TREATMENT PLANT MORRISON MAIERLE INC.			
DATE	2019/02/12				
FILE:					
PROJECT 23711B		DOCUMENT NUMBER 23711B-DS01		SHEET 1 OF 13	REV A



CEI FILTRATION CEI ANTHRACITE CEI LOGISTICS

[Learn More >](#)

WELCOME TO CEI FILTRATION

CEI Companies main headquarters is in Circleville, Ohio in a state of the art 21,000 square foot facility. CEI Anthracite is our anthracite manufacturing facility located on 2.6 acres in Hazleton, PA with a 26,551 square foot office warehouse facility. CEI Logistics is our freight brokerage with over 500 carriers available to handle any freight requirements you may have.

CEI Companies utilizes plants throughout the world that have been approved by our quality control department to be able to supply our customers with high quality filter media at the best possible price no matter where the job may be.

Founded in 1999, Carbon Enterprises Inc. has a state of the art 21,000 square-foot facility which contains all of its supplies, equipment, and operational teams. CEI is also divided into two main companies – CEI Anthracite and CEI Logistics. CEI Anthracite is focused on supplying Anthracite to interested clients, while CEI Logistics is a freight shipping entity with numerous responsibilities. These companies are operated by competent professional teams who can handle large volumes of orders per day. All of the plants owned by CEI are properly monitored to ensure top-notch performance on a constant basis.

Carbon Enterprises Inc. is the real authority when it comes to large-scale water filtration capabilities. Even though other companies compete in the water filtration trade, CEI managed to stay on top. One of the main reasons is sheer adaptability. CEI businesses can adapt in the best ways possible. Whenever a client requests huge orders, CEI Teams prepare ahead of time. Supplies are properly secured, as well as the delivery systems needed. The CEI customer service framework is also excellent in gathering all important details from clients. Whether you need Anthracite, Greensand, Activated Carbon, Gravel, and other filtration materials, Carbon Enterprises Inc. can definitely help you. CEI products are also NSF approved and generally exceed AWWA standards. Even if your budget is limited, CEI can offer practical water filtration solutions.

CEI ANTHRACITE

Our Quality Assurance

We are a leading supplier of quality anthracite for filter beds in the water filtration industry. Our material is required to adhere to the strict standards of the water industry, therefore, our state-of-the-art production facility capabilities far exceed your supply requirements.

Anthracite Processing

Fast, Efficient, Accurate, Providing timely deliveries

*** State-of-the-art sizing plant to guarantee your specifications**

ensuring complete production control and accurate processing.

Our high capacity plant enables CEI to meet your delivery needs.

*** Automated sieve analyzer**

assures consistent product quality permitting precise control of both the raw material and finished product. Computerized testing can be completed within minutes of sample collection, providing our production staff with quick and accurate information.

CEI Anthracite utilizes additional equipment to ensure oversize protection such as totally closed processing equipment as well as preload screening. What this means to our customers is that all material must pass 5 screen protection points before it arrives at its destination. Full time quality control staff assures the customer of high quality products as well as technical assistance based on 50 years in anthracite production. Our plant is capable of providing you with any variation of sizing, and quality.

In addition our large warehouse allows us to retain 800 to 1000 tons of inventory at all times. We have the capability of dramatically increasing production with short notice, which enables us to meet your need and ensure on time deliveries. We meet and exceed AWWA-B100- standards.



“ONE COMPANY FOR ALL YOUR FILTER MEDIA”

Date: 3-28-19

To: Brad Oswalt - Westech

From: Ryan Carter

From: CEI

Pages: 1

Subject: AWWA & NSF Compliance letter – Glasgow, MT

Brad,

CEI only manufactures, sells and distributes products that meet or exceed AWWA B-100-16 standards and are NSF Standard 61 certified and listed for potable water applications. All of the products we sell must be tested before they ship to assure that they meet the required specifications.

CEI has over 25 years of experience in the filter media industry and is a worldwide distributor and manufacturer of filter media for the drinking water industry. CEI has supplied thousands of water plants and manufacturing facilities across the U.S. and overseas.

CEI will be providing filter sand that meets the specifications for Westech on the Glasgow, MT water system improvements.

**Thanks,
Ryan J. Carter
President
CEI**

A handwritten signature in blue ink that reads 'Ryan J. Carter'. The signature is stylized with a large 'R' and a cursive 'Carter'.

**WORLD HEADQUARTERS
CEI**

**28205 Scippo Creek Road
P.O. Box 787
Circleville, Ohio 43113
Phone: 1-800-344-5770
Fax: 1-888-204-9656
www.ceifiltration.com**

**In-House Freight Services
888-808-4984**

CEI ANTHRACITE

**Plant Location
603 S. Church Street
Hazelton, PA 18201
Phone: 570-459-7005
Fax: 570-459-7012
www.ceianthracite.com**



SOLAR TESTING LABORATORIES, INC.

Geotechnical and Environmental Engineering, Materials Testing, and Construction Inspection

1125 Valley Belt Road, Brooklyn Heights, Ohio 44131

Phone: 216-741-7007 • Fax: 216-741-7011

www.stlOhio.com



PROJECT:	CARBON ENTERPRISES, INC. UPL03P	FILE NO.:	S016043
CLIENT:	CARBON ENTERPRISES, INC.	REPORT NO.:	001
		DATE:	

On December 16, 2015, a sample of Anthracite was delivered to Solar Testing Laboratories, Inc. for a material analysis. Following are the test results:

ANTHRACITE		
Sieve Size	Particle Size (mm)	% Passing
#6	3.366	100.0
#8	2.440	99.8
#10	2.062	99.6
#12	1.717	98.4
#14	1.417	78.0
#16	1.203	36.1
#18	1.026	9.9
#20	0.877	2.7
#25	0.717	1.4

Test	Result	Specification
Effective Size (mm)	1.03	0.95 – 1.05
Uniformity Coefficient	1.29	
Acid Solubility, AWWA B100-09 (%)	0.19	
Moh's Hardness	2.8	
Specific Gravity	1.7	
Shape; Flat, Elongated Pieces (3:1 ratio)	3.0	
Ash Content, ASTM D7582 (on dry basis)	13.64%	
Volatiles Content, ASTM D3175 (on dry basis)	4.41%	
Hardgrove Grindability Index (ASTM D409)	34 HGI	
Media Compatibility	18.40	

If you have any questions, please do not hesitate to contact our office.

TECHNICIAN: DONALD HOLLENBAUGH

SOLAR TESTING LABORATORIES, INC.

Dennis L. Sanderson
Vice President/General Manager

jnp 1/6/16
Attachment

PROJECT:
CLIENT: CARBON ENTERPRISES, INC.

FILE NO.: A11027X12
REPORT NO.: 036
DATE:

FILTER SAND		
Sieve Size	Particle Size (mm)	% Passing
#12	1.716	100.0
#14	1.414	99.9
#16	1.199	98.8
#18	1.020	92.1
#20	0.874	75.9
#25	0.715	51.6
#30	0.589	20.4
#35	0.488	5.9
#40	0.414	1.9

Test	Result	Specification
Effective Size (mm)	0.52	0.45 – 0.55
Uniformity Coefficient	1.49	<1.6
Specific Gravity (SSD) (ASTM C128)	2.65	>2.5
Acid Solubility, % (AWWA B100-09)	0.04	<5
Moh's hardness	7	

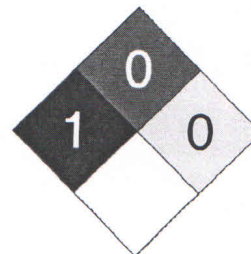
This sample meets project specifications.

1. Product and Company Identification

Product Name Anthracite Coal
CAS # 8029-10-5
Product use Water Treatment Filter Media
Manufacturer Pro Products LLC
 7201 Engle Road
 Fort Wayne, IN 46804-5875 US
 Phone 260-483-2519
 Emergency Phone: 1-800-424-9300 (CHEMTREC)

LEGEND HMIS/NFPA	
Severe	4
Serious	3
Moderate	2
Slight	1
Minimal	0

Health	* 1
Flammability	0
Physical Hazard	0
Personal Protection	X



2. Hazards Identification

Emergency overview CAUTION
 May cause chronic toxic effects.

Potential short term health effects

Routes of exposure Eye, Skin contact, Inhalation, Ingestion.

Eyes May cause irritation.

Skin May cause irritation.

Inhalation Dusts of this product may cause irritation of the nose, throat, and respiratory tract. Prolonged or repeated inhalation may cause lung damage.

Ingestion May cause stomach distress, nausea or vomiting.

Target organs Eyes. Skin. Lungs.

Chronic effects Prolonged or repeated exposure can cause drying, defatting and dermatitis. May cause delayed lung damage.

Signs and symptoms Symptoms may include redness, edema, drying, defatting and cracking of the skin. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting.

OSHA Regulatory Status This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Potential environmental effects Not available

3. Composition / Information on Ingredients

Ingredient(s)	CAS #	Percent
Coal, anthracite	8029-10-5	60 - 100

4. First Aid Measures

First aid procedures

Eye contact Flush with cool water. Remove contact lenses, if applicable, and continue flushing. Obtain medical attention if irritation persists.

Skin contact Brush away excess of dry material. Flush with cool water. Wash with soap and water. Obtain medical attention if irritation persists.

Inhalation If symptoms develop move victim to fresh air. If symptoms persist, obtain medical attention.

Ingestion Do not induce vomiting. Never give anything by mouth if victim is unconscious, or is convulsing. Obtain medical attention.

Updated 7/1/2012

MATERIAL SAFETY DATA SHEET

1. May be used to comply with OSHA's Hazard Communications Standard, 29 CFR 1910.1200 (48 FR 53340).
2. Standards should be consulted for specific requirements.

Identity: Crystalline Silica (Quartz)

SECTION I

Name

CEI

Address

28205 Scippo Creek Rd
Circleville, OH 43113

Telephone: 800-344-5770

Fax: 888-204-9656

SECTION II – HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components:

Silica, Crystalline Quartz (respirable)

Specific Chemical Identity: Silicon Dioxide SiO₂ (CAS 14808-60-7)

Common Names: Silica, Sand, Silica Sand, Crystalline Silica, Quartz, Ground Silica, Safety Sand, Class A Fill, Silica Stone, Gravel, Trapsand, Blasting Sand, Engine Sand, Flume Sand, Shaft Blend, Traction Sand, Ferro 400, Euco 456, Euco 1500, Euco 2500.

OSHA PEL: Exposure to airborne crystalline silica shall not exceed an 8-hour time-weighted average limit as stated in 29 CFR § 1910.1000 Table Z-3 for Mineral Dusts, specifically, "Silica: Crystalline: Quartz (Respirable)."

Crystalline Quartz (Respirable)

mppcf	mg/m³
<u>250</u>	<u>10</u>
% SiO ₂ +5	% SiO ₂ +2

Quartz (Total Dust)

mg/m³
<u>30</u>
% SiO ₂ +2

ACGIH TLV: Crystalline Quartz

TLV—TWA = 0.1 mg/m³ (Respirable Dust)

See Threshold Limit Value and Biological Exposure Indices for 1987-1988

American Conference of Governmental Industrial Hygienists.

Other Limits Recommended: National Institute of Occupational Safety and Health (NIOSH). Recommended standard maximum permissible concentration = 0.05 mg/m³ (respirable free silica) as Recommended Standard Occupational Exposure to Crystalline Silica.

SECTION III – PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point:	4046°F	Specific Gravity (H₂O = 1):	2.65
Vapor Pressure (mm Hg.):	None	Melting Point:	3050°F
Vapor Density (AIR = 1):	None	Evaporation Rate:	
		(Butyl Acetate = 1)	None

Solubility in Water: Insoluble in water

Appearance and Odor: Tan to off-white sand or pebbles, no odor or taste..

SECTION IV – FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): Non-flammable

Flammable Limits: None **LEL:** None **UEL:** None

Extinguishing Media:

None required; sand may be used as extinguishing media.

Special Fire Fighting Procedures: N/A

Unusual Fire and Explosion Hazards:

None, Silica sand may be used to extinguish certain classes of fires.

SECTION V – REACTIVITY DATA

Stability: **Unstable:** **Stable:** X **Conditions to Avoid:** None

Incompatibility (Materials to Avoid):

Contact with powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, oxygen difluoride, may cause fires.

Hazardous Decomposition of Byproducts:

Silica will dissolve in Hydrofluoric Acid and produce a corrosive gas – silicon tetrafluoride.

Hazardous Polymerization: **May Occur:** **Will Not Occur:** X **Condition to Avoid:** None

SECTION VI – HEALTH HAZARD DATA

Route(s) of Entry:

Inhalation? Yes **Skin?** No **Ingestion?** No

Health Hazards (Acute and Chronic):

Prolonged exposure to respirable crystalline quartz may cause delayed (chronic) lung injury (silicosis). Acute or rapidly developing silicosis may occur in a short period of time in heavy exposure in certain occupations such as sandblasters. Silicosis is a form of disabling pulmonary fibrosis which can be progressive and may lead to death.

Carcinogenicity:

NTP? No

IARC monographs? Yes

OSHA regulated? Not as carcinogen.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 42, 1987) concludes that there is sufficient evidence for the carcinogenicity of crystalline silica to experimental animals, and that there is limited evidence of the carcinogenicity of crystalline silica to humans. IARC Class 2A.

Signs and Symptoms of Exposure:

Undue breathlessness, wheezing, cough, and sputum production.

Medical Conditions Generally Aggravated by Exposure:

Pulmonary function may be reduced by inhalation of respirable crystalline silica. Also lung scarring produced by such inhalation may lead to a progressive massive fibrosis of the lung (silicosis) which may aggravate other pulmonary conditions and diseases and which increases susceptibility to pulmonary tuberculosis. Progressive massive fibrosis may be accompanied by right heart enlargement, heart failure, and pulmonary failure. Smoking aggravates the effect of exposure.

Emergency and First Aid Procedures:

For sand in eyes, wash immediately with water. If irritation persists, seek medical attention. For gross inhalation, remove person immediately to fresh air, give artificial respiration as needed, seek medical attention as needed.

SECTION VII – PRECAUTIONS FOR SAFE HANDLING AND USE

Steps To Be Taken In Case Material is Released or Spilled:

Spills: Use dustless methods (vacuum) and place into closable container for disposal, or flush with water. Do not dry sweep. Wear protective equipment specified below.

Waste Disposal Method:

Dispose in accordance with Federal, State, and Local regulations.

Precautions To Be Taken In Handling and Storing:

Avoid breakage of bagged material or spills of bulk material. See control measures in Section VIII.

Other Precautions:

Use dustless systems for handling, storage, and clean up so that airborne dust does not exceed the PEL. Use adequate ventilation and dust collection. Practice good housekeeping. Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain, clean, and fit test respirators in accordance with OSHA regulations. Maintain and test ventilation and dust collection equipment. Wash or vacuum clothing which has become dusty. See also control measures in Section VIII.

See OSHA Hazard Communication Rule 29 CFR Sections 1910.1200, 1915.99, 1917.28, 1918.90, 1926.59, and 1928.21, and state and local worker or community "right to know" laws and regulations. We recommend that smoking be prohibited in all areas where respirators must be used. **WARN YOUR EMPLOYEES (AND YOUR CUSTOMERS—USERS IN CASE OF RESALE) BY POSTING AND OTHER MEANS OF THE HAZARD AND OSHA PRECAUTIONS TO BE USED. PROVIDE TRAINING FOR YOUR EMPLOYEES ABOUT THE OSHA PRECAUTIONS.**

See also American Society for Testing and Material (ASTM) standard practice E 1132-86, "Standard Practice for Health Requirements Relating to Occupational Exposure to Quartz Dust."

SECTION VIII – CONTROL MEASURES

Respiratory Protection (Specify Type)

The following chart specifies the types of respirators which may provide respiratory protection for crystalline silica.

RESPIRATORY PROTECTION FOR CRYSTALLINE SILICA

CONDITION	MINIMUM RESPIRATORY PROTECTION *
Particulate Concentration 5 x PEL or less	Any Dust respirator.
50 x PEL or less	A high efficiency particulate filter respirator with a full face piece. Any supplied-air respirator with a full face piece, helmet or hood. Any self-contained breathing apparatus with a full face piece.
500 x PEL or less	A powered air-purifying respirator with a high efficiency particulate filter. A Type C Supplied-Air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 500 x PEL or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full face piece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full face piece operated in pressure-demand or other positive pressure continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Abrasive Blasting	Any type CE, supplied-air respirator with a full face piece, hood, or helmet, operated in positive-pressure mode.

*Only NIOSH-approved or MSHA-approved equipment should be used.

See also ANSI standard Z88.2-1980 "Practices for Respiratory Protection," and standard Z9.4-1984 "Ventilation and Safe Practices of Abrasive Blasting Operations."

SUMMARY:

Local Exhaust:

Use sufficient exhaust to reduce the level of respirable crystalline silica to the PEL. See ACGIH "Industrial Ventilation, A Manual of Recommended Practice," the latest edition.

Mechanical

See "Other Precautions" under Section VII.

Special

See "Other Precautions" under section VII.

Other

See "Other Precautions" under section VII.

Protective Gloves

Optional

Eye Protection

Wear protective shield (safety glasses) when exposed to dust particles.

Other Protective Clothing and Equipment

Optional

Work/Hygienic Practices

Avoid creating and breathing dust. See "Other Precautions" under Section VII.

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We except no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to silica. Customers-users of silica must comply with applicable health and safety laws, regulations, and orders.

Media Installation

Several workers will be required to install the media. Ladders, shovels, rakes, and scraps of plywood to stand on inside of the filter will be needed. A lift truck is almost essential.

Bulk media may be placed dry by using a chute or conveyor to discharge the materials into cell, from where they may be scattered with a hand trowel.

Bulk media may also be placed hydraulically by pump or ejector.

Workers should not stand or walk directly on the filter media. Place boards or plywood on the media that will sustain their weight without displacing the material.

Note: Before commencing media placement, refer to engineer's specifications for special requirements concerning media installation.

1. See reference drawing and packing list for media specifications, gradations, and depths. Be sure to set aside and store any spare media prior to placing media in filter cells.
2. Media shall be installed in accordance with ANSI/AWWA B100-01.
3. Vacuum clean all surfaces in contact with backwash water supply as directed by engineer's specifications and manufacturer's instructions. Be sure underdrain construction has been installed per Installation, Operation and Maintenance Manual prior to placing media.
4. Care must be taken to protect distribution baffles or strainers from damage when cleaning cells or placing media.
5. Clean each filter thoroughly before any filter media is placed within the filter.
6. Before any media is placed, mark a continuous level line on the inside of the filter to represent the top elevation of each layer of the filter media.
7. Divide filter media equally between the number of filters to be installed.
8. Place filter sand media within the filter cell first.
9. The top elevation of the Anthracite media layer can be checked by filling the filter with water to previously marked line. Screed each layer to a true level plane.
10. The top elevation of each layer should be equal to the finished elevation plus the depth of media required for skimming.

11. After each layer of media has been placed into the filter cell, slowly fill the filter by adding water up through the underdrain.
12. After the media is submerged, slowly backwash the filter.
13. After initial backwash, scrape the filter media as directed by the engineer.
14. The filter should be backwashed three times between additional scrapings if so required.
15. After final scraping add filter media as required to bring the top surface of the media to the correct elevation.
16. Before filter is put into service, disinfect filter as required by engineer.