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ISO 9001 CERTIFIED

CLEANING OF POROUS METAL PRODUCTS

A significant advantage of porous metal material is that it is cleanable and reusable. Metal media can last a very long time if proper care and cleaning is followed. This advantage is usually the paramount consideration in developing economic justification for purchase when comparing short lived or disposable materials. The following information provides requirements and techniques available to properly clean porous metal material and ways of evaluating its effectiveness.

THE PORE STRUCTURE

Let's start with the media itself.
The best description of Mott's porous metal media is to compare it to the structure of a sponge. A series of interconnected, and sometimes disconnected, passageways of irregular size and shape leading from one surface to another. Some of these passageways, or pores, are relatively large and lead directly from one surface to another in a tortuous path which is continuously interrupted by obstacles of metal particles. Others can be smaller or lead to dead ends. These passageways are seldom, if ever, the same width or length, rather they vary in size, shape and dimension from one surface to another.

Solid material moving through these passageways, either carried by liquids or gases, can get caught by a variety of mechanisms within the pore structure and eventually block it. If the materials are not removed, the media is fouled or plugged and obstruct fluid movement through it as desired by the application. When this happens to an undesirable degree, the media must be cleaned by removing the trapped material. Since the trapped material can occur at or on the media surface and/or within the depth of the media, the method of removal must take into consideration where the fouling material resides and how it is held in place. In order to come up with an effective cleaning procedure, it helps to know which circumstances exist.

TYPES OF FOULANTS

INORGANIC: Solids captured in or on the media surface can be metals, salts, oxides, hydroxides, and mixtures of materials. Generally considered to be of non-carbon composition.

ORGANIC: Oils and greases, carbon and coke, waxes, gums, tars, and polymers. Generally considered as being derived from petroleum compounds.

BIOLOGICAL: Bacteria and other types of cell animals, algae and fungi, proteins and other food or plant produced materials.

These foulants can occur singly or in combinations. By knowing the exposure of the media, one can establish what the most likely and prevalent foulant material could be. This identification is essential in determining the most effective cleaning procedure to use. In many cases, different cleaning processes must be used in succession to be effective.

The degree of fouling will be different for each type of material previously listed. Solids are most likely caught on or near the surface of exposure, unless fine particles are dragged into the pore structure by fluid flow and are captured by the depth effects of the media. Some solid fouling is caused by precipitation of dissolved materials onto the media surfaces. These solids will be found throughout the media structure. Organic and biological fouling will also most likely be throughout the media.

CLEANING TECHNIQUES

The following methods of cleaning porous materials are generally accepted as being effective, reasonably economical and available to most users of porous materials. Specific cleaning procedures must be developed for specific situations; most of which will consist of one or more of the following:

- Blowback and backwash flushing
- Soak and flush
- Circulation flows
- Ultrasonic baths
- Furnace cleaning
- Hydroblasting

Blowback and backwash cleaning is the simplest cleaning method and is the routine method recommended for our process filters. For backwash to work, we are relying on the reverse flow of liquid to pick up and transport particles out of the media structure. The liquids are usually filtrate or some other process compatible fluid. This method depends on the particles being loosely held on or within the pore structure. For deeply imbedded particles, multiple blowbacks will be necessary. When gas is used as the pressure source over the liquid, much turbulence is created as a gas/liquid mixture is forced through the media which disturbs particles and helps remove them from the structure.

Soak and flush typically refers to the introduction of a detergent solution, allowing it to soak long enough for the detergent action to loosen particles then flushing them out of the media. This can be done in process filters or with small parts in a laboratory.

Circulation flows. This method requires a cleaning system to pump and circulate a cleaning solution through the media until it is clean. Normally the circulation is in the reverse direction from which the media was fouled. Solids removed must be filtered out before the solution is returned to the media. This process is useful when materials must be dissolved out.

Ultrasonic baths. Special equipment is necessary to use ultrasonic sound waves to excite particles and move them out of the media. Small parts are easily cleaned in laboratory models while element bundles require large tank set ups with high power inputs. Used in conjunction with the proper detergent solution, ultrasonic cleaning is the most effective procedure for deeply imbedded particles.

Furnace cleaning is a simple method of burning or volatizing organic or biological compounds. Polymer materials are removed most effectively this way. It is best used for materials which leave no ash residue, otherwise this residue must be removed by additional cleaning methods.

Hydroblasting is a technique which usually precludes other cleaning methods if the foulant is grossly adhered to the media surface. Crossflow tubes have been cleaned this way. The high pressure water blast removes materials by high-energy impaction. It does not penetrate very deeply into the media structure, but in most cases the fouling may be only at the media surface. It is also a common practice in plants, typically being used to clean heat exchanger tubes. This method has been used successfully by one commercial cleaning firm to remove catalyst plugging on the inside of our filter elements.

CLEANING SOLUTIONS

The use of an appropriate cleaning solution is essential to getting the desired results when used with one or more of the mentioned cleaning processes. Think of cleaning porous materials as washing clothes. The objective is to pick up the dirt from the media, suspend it in the detergent, and flush it away. Rinse in clean water to remove the detergent residue and you're done. Pick the right detergent based on the type of dirt.

For inorganic compounds: Dilute acids which will not attack the base metal (such as Nitric, Phosphoric, Citric, Oxalic) sometimes used with detergent additives. Caustics. Commercial scale removers: Oakite 31 and 33 (acidic), Oakite Low Heat Cleaner 3 (alkaline), Calgon EZE 294S (alkaline), and Alkonox Citranox (acidic).

For organic foulants: Caustic cleaners work best, in addition to solvents, soaps and detergents. Consider some of the commercial household detergents also. In the case of mixed foulants, use caustics to remove oils, then the acidic cleaners or acids to remove scale and mineral deposits.

For biologicals: Look to strong oxidizing agents such as Clorox (sodium hypochlorite), peroxide, and both acidic and caustic cleaners. Alconox TERG-A-ZYME is effective on proteins and food residues.

TESTING FOR EFFECTIVENESS

After the cleaning process has been completed, the parts must be tested to determined if they are in fact clean. A standard bubblepoint test followed by uniform bubbling will reveal areas not cleaned. If possible, an air or liquid test will confirm recovery of permeability. It may not be necessary to clean to the extent of new media…only to the point necessary to make the part serviceable.

COMMERCIAL CLEANING COMPANIES

It is recommended that those who do not have experience with the techniques noted above contact a qualified commercial cleaning company. They are best equipped to explore the various cleaning regimes available for your specific contaminant requirements.

Mott offers the following listings as a courtesy to our customers. To the best of our knowledge, the listings as they appear are current and accurate.

B&M Longworth (Edgworth) Ltd.
Sett End Road North, Shadsworth Business Park
Blackburn, Lancashire BB1 2QG UNITED KINGDOM
Tel. +44 01254 680501
Fax. +44 01254 686539
www.bmlongworth.com / E-Mail: enquiries@bmlongworth.com

Carolina Filters, Inc.
109 E. Newberry Avenue
Sumter, SC 29150
www.carolinafilters.com
Phone: 800-849-5656 / info@carolinafilters.com

COMMERCIAL CLEANING COMPANIES

(cont'd)

Fil-Clean LLC
6122 Gardendale Drive
Houston, TX 77092
Phone: 713-682-3782 Fax: 713-682-3627
www.Fil-cleanllc.com

Southern Metal Processing Company
130 Allred Lane
Oxford, AL 36203
Phone: 256-831-8130; Fax: 256-831-2103
www.southern-metal.com

Southern Metal Processing Company
4750 W. Cedar Bayou, Lynchburg Road
Baytown, TX 77521
Phone: 281-424-3324; Fax: 281-424-1698
www.southern-metal.com

Precision Processing Services Ltd.
Carrakeel Industrial Estate
Maydown Londonberry UK BT47 6TR
Phone: +44-2871-861-600; Fax: +44-2871-861-211
E-mail: enquiries@ppsl-precision.com
www.ppsl-precision.com

Cathay Chemical (Dalian)
19th F, Shangdu Building, No. 478 Zhongshan Road
Celeb Manor Mansion , Dalian, P.R. China 116021
Phone: +86-411-8433-5384; Fax: +86-411-8433-5384
E-Mail: liuyutong@cathaychem.com

CLEANING SOLUTION SUPPLIERS

Alconox Inc.
30 Glenn Street, Suite 309
White Plains, NY 10603
Phone: 914-948-4040
www.alconox.com

Calgon Carbon Corporation
500 Calgon Carbon Drive
Pittsburgh, PA 15205
Phone: 800-422-7266
www.calgoncarbon.com

Chemetall Americas
675 Central Avenue
New Providence, NJ 07974
Phone: 800-526-4473
www.chemetallamericas.com

ULTRASONIC EQUIPMENT

Branson Ultrasonics Corp
41 Eagle Road
Danbury, CT 06813-1961
Phone: 203-796-0400

Jensen Fabricating (JenFab)
555 Wethersfield Road
Berlin, CT 06037
Phone: 860-828-6516
www.jenfab.com

Stoelting/Lewis
102 Willbrock Road
Oxford, CT 06478
Phone: 203-266-0470
www.lewissonics.com

FLUID BED MANUFACTURERS

Procedyne Corporation
11 Industrial Drive
New Brunswick, NJ 08901
Phone: 732-249-8347
info@procedyne.com
www.procedyne.com

See following pages for Bubble Testing Procedure and Flow Testing Procedures.

BUBBLE TESTING PROCEDURE

1. Set pressure at regulator to approximately the maximum pressure capacity of the manometer.
2. Saturate the element in isopropyl alcohol.
3. Insert cork and Poly-Flo tubing into the open end of the element.
4. Submerge element in tank to 1" below the surface of the alcohol.
5. Slowly open the metering valve until the first column of bubbles is observed coming from the porous media.
6. Subtract 1" of water from the manometer reading to obtain the "bubble point".

Leak Testing Procedure

7. Follow steps 1 through 4 above.
8. Slowly open the metering valve and bring the pressure on the manometer up to the minimum "bubble point" for the media being tested plus 1" of water. If no bubbles emanate from the element up to this pressure, the element is acceptable and meets the Mott standard for filtration.

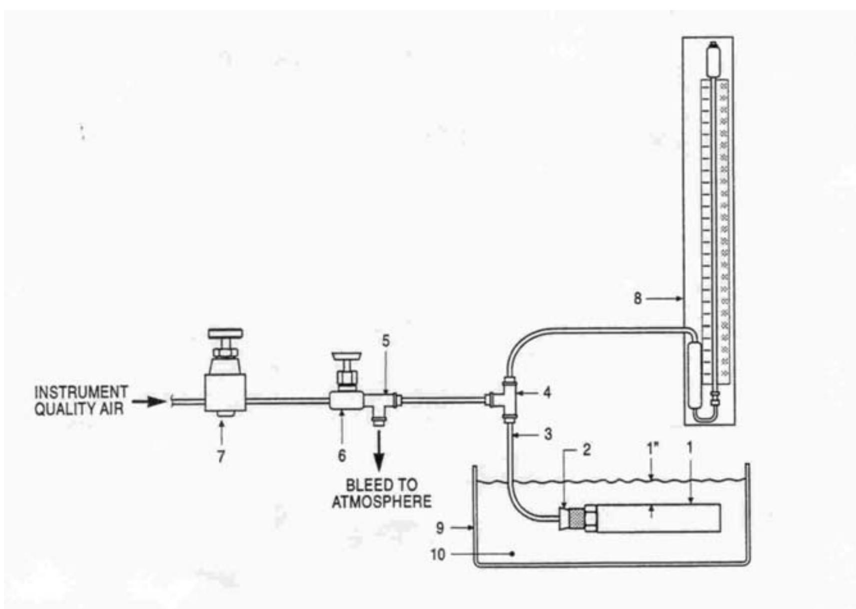
Mott Bubble Point Standards

Nominal Filtration Grades – Micrometers

0.2µm – 5.0-6.9" Hg	10µm – 7.5-10.9" H_2O
0.5µm – 3.0-3.9" Hg	20µm – 5.0-7.0" H_2O
2µm – 17.0-24.0" H_2O	40µm – 3.0-4.0" H_2O
5µm – 13.0-16.9" H_2O	100µm – 0.5-1.5" H_2O

Suggested Bill of Materials

1. Element to be tested.
2. Bored-through rubber cork, as required, with solid cork in opposite end of elements with both ends open.
3. Poly-Flo ¼" tubing or equivalent, as required.
4. Union tee, Imperial Eastman 264-P-04, or equivalent.
5. Male run tee, Imperial Eastman 271-SP-04x02, or equivalent. Remove nut from branch and pinch inner guide tube for bleed to atmosphere.
6. Metering valve, Hoke 2311-F2B, or equivalent.
7. Pressure regulator, as required.
8. Well type direct reading manometer, Dwyer 1230-24, or equivalent. Use mercury for 0.2µm and 0.5µm elements, and water for 2µm and above.
9. Stainless steel tank, as required.
10. Isopropyl alcohol.



FLOW TESTING PROCEDURE

1. Probe tube should extend halfway (1/2 L) into the element.
2. Set the instrument air flow at 2 SCFM/sq ft of porous area on the flow meter (Item 9 below).
3. Read the differential pressure from the manometer (Item 8 below).
4. Serialize the elements and record the flow data.

Suggested Bill of Materials

1. Element to be tested.
2. Probe tube, ¼" x 0.035" wall, length as required, stainless steel.
3. Tee, NPT size as required, stainless steel.
4. Reducer bushing down to ¼" NPT, stainless steel.
5. Bored-through male connector, Swagelok® SS-400-1-BT, or equivalent.
6. Union, Swagelok® SS-400-6 with SS-405-3 plastic tubing insert, or equivalent.
7. Poly-Flo ¼" tubing or equivalent, as required.
8. Well type direct reading manometer, Dwyer 1230-24, or equivalent. Use mercury for 0.2μm or 0.5μm elements, and water for 2μm and above.
9. Flow meter, Dwyer RMC-121 (1-10 SCFM), or equivalent
10. Double bored-through rubber cork, as required, with solid cork in opposite end of elements with both ends open.