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September 2022



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We look forward to seeing you in-person for our September meeting at the Danish Canadian Club (27 11 Ave SW, Calgary, AB) on Tuesday September 13, 2022.

President's Message



I hope this message finds you and yours well and in good health

Welcome to a new year with the Building Operators Association. It has come about that after 2.5 years away from in person meeting that we are finally putting together our 'in-person' September meeting at the Danish Canadian Club (727 11th Ave SW Calgary). We will meet at the same time at 5PM on the second floor; coffee and finger food will be provided. I hope to see you there. Mark Arton has arranged for a Guest speaker from Engineered Air. New technology as well as more efficient equipment will be presented at the meeting. In the age of reducing our operating costs and taking advantage of financial support from initiatives, this would be a great meeting to attend.

The fun never stops, come the October meeting, we are setting the date back for one week to the 18th of October for the Building Operators Association Trade Show from 11:00 to 18:00. It has been over 4 years since we had the last one. It will still be at the Danish Canadian Club, and we have the doors open at 11:00am because



Building Operators Association
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we have added Guest speakers throughout the event. Our keynote speaker is Heather Campbell B.E.Sc., LL.M., P. Eng. Heather is the Executive Director of Clean Technology with Alberta Innovates. She has had a diverse twenty-five-year energy career with technical, policy, and business roles in a full range of energy industries. Her talk will be at 11:30am Carmichael Energy will deliver present on Energy Benchmarking, Excel's presentation is from 3pm-4pm and Aqua Air will present from 4pm-5pm. It would kind if you can register for which session you would like to attend, so I know how many to expect. Please email me president@boacalgary.com and let me know your coming.

BOMA Calgary is still taking names for the next Building Operator Course; if your interested in attending call them at 403-237-0559.

Well bye for now; I look forward to seeing you in September, in-person!

Smiles))

With kind regards,

Les Anderson PE, RPA



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TEST YOUR OPERATOR IQ!



Are you equally adept at troubleshooting problems in the boardroom and the boiler room? As the resident facility guru, there's a lot riding on whether or not you know the difference between sounds control and a sound investment.

Try our monthly Operator IQ challenge...answers on page 27

1. If operating personnel from an old building are going to be transferred to the new building the system installed in the new building will be the same as in the older building because all the personnel are familiar with that system. This type of system selection is based mainly on which of the following Factors?

- a) building owners considerations
- b) geographical location
- c) building layout
- d) operating costs
- e) maintenance requirements



2. One of the following is required to offset the heat gain through the building's exterior shell from solar radiation, from the atmosphere surrounding, and from internal sources of heat is:

- a) a humidifier
- b) a heat source
- c) ventilation
- d) a cooling system
- e) a dehumidifier

3. The category of air conditioning which is responsible for getting outside air into the building to replenish the oxygen supply for the occupants is:

- a) heating
- b) cooling
- c) ventilation
- d) humidification
- e) air circulation

4. The intake section arrangement which draws in room air, conditions it, and then returns it into the room is called:

- a) fixed percentage outdoor air circulation
- b) full recirculation
- c) 100% outdoor air circulation
- d) mixed air circulation
- e) blended circulation

5. Which of the following statements about air handling units is true?

- a) in any air conditioning system the air is mainly conditioned in the air handling units
- b) the units can only heat air
- c) the units only circulate
- d) for each function there needs to be a separate air handling unit
- e) none of the above



Going with the Flow

by Thomas Westerkamp

New technology to assess and address drain and pipe problems puts additional power in the hands of front-line technicians

Today's drain cleaning systems are a far cry from the rudimentary systems employed by maintenance departments in years past to keep plumbing systems operating and pipes flowing smoothly. These advanced systems feature improvements in materials, designs and technology that enable managers to put greater power in the hands of front-line plumbers and equipment technicians, which can enable them to diagnose plumbing system problems more quickly and accurately. The options available to today's technicians for assessing pipeline problems generally fall into two categories — mechanical and chemical.



Equipment options

Mechanical cleaning includes everything from the old standby manual plungers and augers to today's faster and more powerful motor- or engine-driven power cleaners. Typical examples of mechanical cleaners found in a plumber's arsenal include:

- **Hand cleaners.** Two common types are closet augers and hand spinners. Closet augers with flexible, 1/2-inch inner core cable can snake through traps, even in newer, low-flow closets. Workers also can use portable electric or battery-operated hand spinners on small drain blockages in sinks. They



- have a range of 50 feet and a vinyl-wrapped, flexible inner core cable housed in a plastic drum. They will not rust or dent and clean easily.
- **Sectional cable machines.** These units can be electric or gas driven and can clean lines up to 300 feet. They are available for application in 1-1/4 to 10 -inch diameter pipe and in increments of 1-1/4 inches to 4 inches, 2 – 8 inches, 2 – 10 inches, etc. Speeds of 600-700 rpm enable them to remove buildup and cut roots that invade underground drains.
- **Drum-type cable machines.** These units have quick-disconnect drums and quick- connect couplers for faster setup and easier transport through narrow passages. They also are designed for problems with sink and

floor drains, and they offer line diameters ranging from 1-1/4 inches to 10 inches, cable lengths of up to 250 feet, and in- and out-feed rates of more than 20 feet per minute.

- **Rodders.** For heavy-duty, large diameter pipe, rodders with an attached gas engine can handle up to 500 feet of line length with sectional rod and up to 24 inch-diameter pipe.
- **Water-jet machines.** Water jet machines are driven by either electric or gas engines. Typical electric units handle more than 200 feet of 1-1/4 – 4 inch drain. Connected to a water source, they deliver high-velocity pulses of water forward and backward at 1,250 pounds of thrust to remove sludge buildup. Gas units remove soap, grease and sludge in 1-1/4 inch to 6 inch drain lines. A 5-1/2 hp drive delivers pressure at 2,100 psi, which is controlled by a foot valve. Both electric and gas units can be hand-carried or two-wheel-cart-mounted with hose.

Imaging technology

The gradual forms of pipe deterioration that maintenance and engineering technicians face include drainpipe wall buildup, erosion, corrosion, root invasion, cavities, sagging and cracks. Managers need to assess risks, understand equipment options, and sell a solution to management. These steps are best taken before a middle-of-the-night emergency occurs.

With up-to-date drain inspection equipment, smart managers can mitigate risks by viewing the condition of a drainage system at

periodic intervals, documenting impending problems, and recording the findings using both audio and video of the actual interior condition of the lines to backup recommendations for corrective action.

The conventional method has been remotely controlled closed-circuit television (CCTV), a process by which a TV camera is inserted into the pipeline to make an analog recording. The camera is mounted on a track device that propels it through the pipeline and records distance, time and date. The device enables the operator to make audio comments of observations, as well as color videotapes, DVDs or still photos.



An alternative for smaller pipelines is a monitor on the surface connected to a Kevlar sleeved fiberglass cable that is inserted into the pipe for recording. Trenchless pipeline rehabilitation is a cost-effective alternative to open-trench repairs.

The disadvantage of CCTV is that it is subject to operator interpretation and varying quality of the TV pictures. Errors are most likely to occur in assessing early defects or deterioration that generally are not easily seen. As a result, inspectors might believe that

complete relining is the best option, when in fact only spot repairs are needed, or that spot repairs are done when complete relining is needed.

Digital decisions

More recently, facilities have begun using digital imaging to assess pipeline condition. This technology is driven by the inconsistency of CCTV data. Benefits of digital imaging include more consistent and higher quality images, as well as the ability to do computer-assisted data analysis.

For example, a Java-based analysis now in use makes data less susceptible to operator error and enables users to scan and measure joint separation and accurately assess pipeline defects, including ovality of pipe and depth of cavities. Software allows user-defined coding of defects for automatic summary and analysis and user-defined reports. On-board sensors capture vertical and horizontal pipe deflection since installation, possible indicators of stresses from shifting soil that can cause failure.

In its third generation, digital optical scanning technology Digital data can be reviewed on line, stored on CD or DVD, or seamlessly transferred to an asset management system for further evaluation and easy archiving. When reviewing data, the user can go to any point in the pipeline image instantly. When combined with the analytical software that is available today, digital data can help technicians more accurately assess the condition of the pipeline — the key to cost-effective and high-quality rehabilitation.

Chemical Considerations

Chemicals used for drain and pipe cleaning include biological agents and a variety of inorganic chemicals. These cleaners are application specific. For example, if the problem involves a drain that is plugged with fats, grease or oils, bio-augmentation drain cleaners provide a solution. Naturally occurring microorganisms feed on waste buildup and remove it from drains. Bio-augmentation is environmentally safe and non-corrosive.

On the other hand, if the problem involves a floor drain used for photographic development or radiology waste, the buildup likely is a combination of calcium carbonate from the developer and iron deposits from steel wool silver recovery.



Solid buildup is very difficult to clean. The best solution is a cleaner specified for calcium carbonate and iron removal. This liquid material is easy to use, safe for use in iron and plastic pipe, and meets standards for non-corrosive cleaners.

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Q & A: Puzzling Oil Analysis Results

by Jason Kopschinsky, Noria Corporation



"Sometimes our oil analysis reports show high particle counts on a hydraulic system - as high as ISO 21/18. If wear metals and silicon are low, less than 4 ppm, what are these particles?"

To fully understand the composition of the particles, a spectrographic analysis and a metallurgy assessment of your system components will tell you what the particles are and where they are coming from. At 4 ppm, the amount of wear metals is insignificant.

Retest the system on a proper frequency and trend the rate of change. Significant change in the overall amount of wear metals is cause for concern. If the value of wear metals hovers around the same ppm over each test, then you are probably looking at a product of normal operation. Keep in mind that spectroanalysis can pick up particles only 7 microns and smaller at absolute best. The accuracy

can also be off by significant values on some metals.

I suggest you approach your concern with ferrous density and a patch test after a particle count. Set your target cleanliness for particle count. If the tested value is greater than the target value, proceed to a ferrous density test. Set a target for this value as well, maybe 15 percent ferrous. If the value of the ferrous density exceeds 15 percent, proceed to an analytical ferrography. If the value of the ferrous density is less than 15 percent, proceed to a patch test (filtergram). Keep an eye out for high rate of change in any of the tested values and you will be able catch problems before they occur.

It is also a good idea to assess the condition and effectiveness of your breathers and filters to make sure you are keeping contamination out and removing it effectively when it gets in.

Treatment of Closed and Glycol Loop

by Kathryn L. Fisher

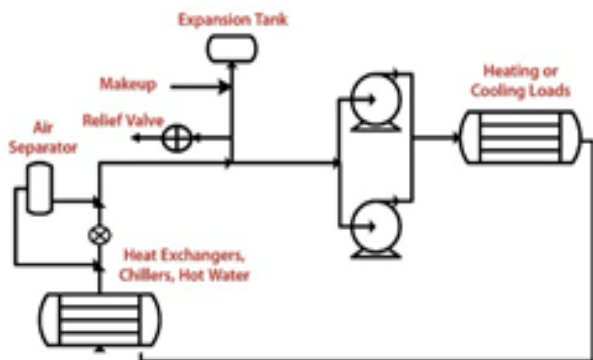
The presentation dealt with the different types of treatment associated with closed systems, as well as ethylene and propyleneglycol.



Essentially, there are three different types of treatment currently being used in the marketplace: Sodium Molybdate, Sodium Nitrite, and All-Organic. There are advantages and disadvantages to all three treatments, which we discussed. Molybdate based treatments are low in dissolved solids and are not a nutrient for bacteria. The disadvantage, however, is that molybdenum is a heavy metal, which raises certain environmental issues. Nitrite based products are higher in dissolved solids and are a

nutrient for bacteria, however, the nitrite is not a heavy metal. Both are proven corrosion inhibitors and work well. The newest of the treatments is the All-organic type. It was developed to deal with the environmental concerns. Unfortunately, the technology is not completely proven yet.

Next, we discussed the differences between propylene and ethylene glycol. Ethylene is the most widely used glycol as it is a bit cheaper than propylene. Ethylene is considered to be toxic, whereas propylene is not. Both varieties are available in inhibited and uninhibited. inhibited glycol is usually chosen over uninhibited to protect your system when the glycol eventually breaks down. When glycol breaks down, it forms acidic by-products which lower the pH of the system, which causes corrosion. The inhibitors added are buffering agents for this specific purpose. Both inhibited and uninhibited glycol is normally overlaid with separate corrosion inhibitors to provide extra corrosion protection to the system.



The symptoms for glycol breakdown are as follows:

1. **Discolouration to an amber or brown**
2. **The pH drops**
3. **Conductivity rises**
4. **Glycol percentage drops somewhat**

One final note for your glycol systems is to watch for bacteria. At low percentages, glycol (ethylene and propylene) is a nutrient

for bacteria. Originally, it was thought that 20% was the percentage required to keep bacteria from your system, however, recent research has found certain strains that can survive beyond 20%. The systems are similar to glycol breakdown, and you will also see signs on your side stream filters and corrosion coupons.

Here is a chart referring ethylene glycol percentages with freeze protection:

% Ethylene Glycol	Freeze Protection °C
25	- 12
30	- 16
35	- 20
40	- 25
45	- 31
50	- 37
55	- 45
60	- 52



KenKen Puzzle

How to solve the KenKen puzzle:

(Answers on page 27)

- Fill in the numbers from 1 –6
- Do not repeat the number in any row or column
- The numbers in each heavily outlined set of squares, called cages, must combine (in any order) to produce the target number in the top corner using the mathematical operation indicated
- Cages with just one square should be filled in with the target number in the top corner
- A number can be repeated within a cage as long as it in the same or column

1	10 x		1 -	2 -	3 -
3 +		2 ÷			
20 x	2 ÷		3 ÷	2 ÷	4
		2			6 +
2 ÷	20 x		6 x		
	4	5 -		3 -	



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FLOOR MAINTENANCE

by Thomas A. Westerkamp

Sealing in Floor Performance

Proper surface preparation and testing goes a long way in determining the long-term performance of floor coatings



As manufacturers continue their efforts to improve the performance of paints and coatings, many of the basics of successfully applying floor coatings remain constant and essential for success. Among the most important of these essential steps is surface preparation.

A closer look at the preparation process and the equipment involved will help managers ensure coating performance.



Surface preparation

Extending the life of floor coatings depends so heavily on surface preparation that the best paint contractors will decline to bid on a job if they know the substrate condition cannot be properly prepared. For example, if a below-grade or on-grade concrete floor has been installed without at least a 10 mil

vapor barrier and there is considerable moisture beneath the concrete, they know a coating will not last long, no matter what they do to the surface to prepare it.

This step is so important that all reputable contractors perform standard tests to determine if a floor meets minimum conditions for a successful job.

Typical situations that spell trouble for new floors are new concrete not properly dried and old concrete not properly insulated. New concrete requires a drying period, and an average of 30 days is not enough in all cases. Among the factors affecting drying time are: an absence of a vapor barrier; a high water table on below-ground floors that creates hydrostatic pressure; the use of curing compounds; pumped concrete with more water in the mix; and the installation of flooring over concrete before the HVAC system is operating.

Old concrete can produce different problems, especially if the building use has changed from its original intent. For example, if an old warehouse with a concrete floor is converted into condos or offices, a school, or a medical clinic, the owner is setting himself up for a disaster by sealing concrete floors with wood, tile, or seamless paints and coatings.

Many old warehouses are structurally very sound and represent a low-cost way to

obtain a shell, but the old warehouse probably never had a vapor barrier installed under the floor. Covering it with anything traps the vapor under the paint, coating, or carpet or tile adhesive that had been escaping into the indoor atmosphere. The moisture mixes with the coating and creates a mess.

How can managers avoid such problems? The American Society for Testing of Materials has developed standards for testing concrete to determine whether it is a satisfactory substrate for the product to be used.

The first standard test is ASTM F-1869, Standard Test Method for Measuring Vapor Emission Rate on Concrete Sub-floor Using Anhydrous Calcium Chloride. A known weight of calcium chloride is placed under a plastic cover for a specific period of time. The chemical absorbs moisture from the concrete and is weighed. The weight gain is converted to pounds per 1,000 square feet per 24 hours, which is the manufacturer's product rating. For most resilient flooring and carpet, a gain of 3-5 pounds is permissible.

A second standard is ASTM F-2170-02, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes. This test, thought to be a more accurate predictor of future

moisture, involves drilling a hole in the slab and measuring the relative humidity. Managers can repeat the test using the same hole without the waiting time after cleaning that is required by using the calcium-chloride test. The actual measurement is compared to the manufacturer's recommended permissible percent relative humidity to determine the suitability of the substrate.



Pseudo-tests for floors — such as taping a plastic sheet over the floor area and using moisture meters — might indicate the need for further testing. But they are not adequate for the final determination. Experts recommend that only qualified agencies perform vapor-emission tests to ensure independent, accurate results.

In addition to moisture testing and control, other factors play a part in determining the best paints or coatings. Among these factors are floor use — both the amount and type of traffic — and atmospheric conditions, such as the presence of corrosive elements.

Equipment selection

Once a floor coating is selected, selecting equipment for surface preparation is the next hurdle to clear. The time and cost for this process are substantial, but they are well worth the extra effort because they can result in additional years of service.



Whether the floor is concrete or wood, the substrate and the paint or coating determine the surface-preparation method. The resulting paint finish quality and durability depend largely on complete and meticulous surface



preparation. Essential surface preparation equipment and features are as follows:

Grinders. These units grind off dirt and paint, vacuuming as they go. They typically have three-headed, counter-rotating blades, operate in the 2 horsepower range at 400-800 rpm, weigh 150-300 pounds, and have diameters of 15 inches for small jobs and up to 30 inches for large jobs.

Polishers. High-speed polishers use a two-step approach — diamond polishing for coating removal, followed by high-speed buffing. The best applications are: finishing wood or new, hardened concrete; restoring old, worn surfaces; and restoring sealers. The resulting finish is a shiny, maintenance-free surface.

Sand and shotblasters. This equipment uses a mixture of sand or shot and air under high



pressure to clean concrete, as well as to remove mastic, epoxy, rubber, and sealer. Typical equipment sizes are 10- to 30-inch-wide paths.

Ultra-high-pressure water blasters. An alternative to sandblasting is using water pressure up to 40,000 psi. It eliminates airborne dust, grit and paint while removing paint, scale, rust and coatings from horizontal, vertical or overhead concrete and steel surfaces. A typical hand wand covers a cleaning path up to 4 inches wide.

Carbide scrapers. For large jobs, a riding rotary scraper cuts away and removes asphalt, thin-set, epoxy, urethane, tile and carpet mastics, waterproofing, and membrane materials in one step. It uses a three-head rotary and oscillating cutter to cover a 30-inch path and contains an attachment for vacuuming up dust and loose materials.

Workers also can use a variety of hand and portable power tools when working in offices, labs, shops, garages, hallways, and other areas in which the cost or maneuverability of large power units is prohibitive. They are more labor intensive, but they work well for carpet or tile backing and mastic, wood and composite gym floors, parquet, and planked floors. With these tools, a crew of two can strip off old tile or carpet and apply a new surface in a day if the substrate is in good condition.

The right combination of floor surface preparation, moisture testing, and coating selection will yield longer performance life for a facility's floor paints and coatings at a reasonable cost.

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Come & visit us at the



BOA Trade Show

Tuesday October 18, 2022

Danish Canadian Club, 727 - 11th Ave SW

Doors Open at 11am until 6pm

**30+ Exhibitors - New Technology - Latest Innovations -
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Keynote Speakers:

Heather Campbell, Executive Director, Clean Technology, Alberta Innovates 11:30am - 1pm
Opportunities using hydrogen's possible role in the decarbonization and energy transition landscape for heating in residential & commercial buildings in Alberta, Canada.

Carmichael Engineering 1:30pm - 3:00pm
Energy Benchmarking Symposium Workshop

David Lamarre, P.Eng., Associate, Exel Systems Inc. 3pm - 4pm
The Benefits and Best Practices of Cooling Tower Filtration

David Lima CET, Aqua Air 4pm - 5pm
Fan Efficiency and Retrofitting Fans with Maintenance Free System

We hope to see you there!

Please register for the Keynote Speaker sessions: president@boacalgary.com

More information: www.boacalgary.com



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Effective Maintenance of Filtration Systems (part 2)

by C.H. Gordon

In part 1 of this article we discussed the "common type of filters; understanding efficiency terminology; service procedures for air filtration systems and specific instructions for servicing air filters". Part 2 will inform you about "specific instructions for types of filters; time standards for servicing major filter types; modifying and upgrading filter systems; what to do when filtration has not been maintained and conclusion - the pay-off."

Specific instructions for types of filters

Roll Renewable Media

Roll media filters come in a variety of media constructions and resulting efficiency characteristics that allow their use as a prefilter, used alone as the principal filtration device, or to retain agglomerated dust from electrostatic precipitators. The distinguishing feature roll media filters have in common is the use of two spools on either side of the plenum, advancing clean filter media as the used media reaches its final resistance, just as film is advanced in a camera after taking a picture.

The media usually is marked for the last few feet of the roll to show that a clean roll will be needed soon. Some models have a media runout switch actuated through an arm resting on the clean media roll. When the supply is exhausted, this switch opens the circuit, stopping the drive motor and turning on a warning light.

To change media rolls, first the old roll must be advanced to run off the remaining media onto the rewind spool. Then the drive switch must be moved to the off position. Remove the used roll and store in carton for removal and final disposal. Take the empty spool from the supply side and put it into the rewind side. The new roll will be covered with a paper wrapper. Leave this on until the roll is completely in place, as it keeps the media from unrolling as the roll is on a spool under tension.



After placing the new roll in the metal media cover; and assuring that all pins, slots, latches, etc., are in proper position, remove the paper wrapper and unwind the media to the rewind spool. The media must rewind spool into the drive socket. Install the keeper. Engage momentary contact switch and test operation by allowing rewind spool to make two revolutions. The filter should now be ready.

Activated Carbon Filters

The primary task in servicing activated carbon filters is to replace the odor-saturated carbon with new carbon. The trick is to know when to

replace the carbon, since pressure drop and visual methods are meaningless. Waiting until objectionable odors become noticeable is not recommended. Most activated carbon units are constructed of a number of metal trays filled with activated carbon and stacked like building blocks with alternate ends sealed together by a gasket so that the entire surface of all the trays is presented to the air stream. The number of trays required is a function of the amount of carbon per tray and the



velocity of the air flow. Typically, as few as six trays containing 2.5 pounds each would be required for 500 cfm at a velocity of 250 feet per minute. A large bank for 36,000 cfm at 500 feet per minute would require 432 trays of 3.75 pounds of carbon each.

One obvious solution is to have extra trays on hand at all times. This allows exchanging a fresh tray for one in service so that it may be laboratory tested to predict remaining useful life of carbon. Some manufacturers will perform the test at no charge. If the useful life remaining is sufficient, new trays may be exchanged for old, a few at a time so that not all trays must be renewed at once. Carbon, available in bulk or trays, may be returned to the manufacturer for renewing.

Some carbon filters units are front-opening and some are side-opening. In either case, the trays slide out and are resealed by gaskets.

Electronic Air Cleaners

Agglomeration with Disposable Collector Media: The more modern electronic air cleaners for large installations employ the agglomeration principle. This means that dust particles build upon the collection plates until they break off in larger chunks and are



carried downstream to the collection media, which may be bag filters or roll media. The pressure drop across the filter bank gives the cue for removal of soiled media. Standard servicing procedures are followed for the particular media type.

Household Size Electronic Air Cleaners: The typical electronic cleaner for household use fits into an air plenum register or duct. The entire collector unit slides out and may be washed in a conventional dishwasher.

Electrical/Mechanical Servicing: Besides the agglomeration collection media, all electronic air cleaners have two components in common that require periodic maintenance: the power pack, and the ionizer section.

The power pack is a rectifier that supplies high voltage DC current to ionizer wires and plates. It should be checked regularly for proper operation.

The ionizer section should also be checked

Filter Type and Operation	Unit Service Time
Permanent Metal Panel Filters	
- Remove and replace - Wash, dry, and recoat	0.75 minutes each 4 minutes each
Permanent Foam Panel Filters	
- Remove and replace - Wash and dry	0.75 minutes each 2 minutes each
Disposable Panel Filters	
- Remove and replace	0.75 minutes each
Replaceable Media/Metal Frames	
Open frame, remove, replace and close	1.5 minutes each
Extended Surface Media Filters up to 24"x24"x36"	
Remove and replace	1 - 2 minutes each
Roll Renewable Media up to 8 ft width	
Remove and replace	45 - 120 minutes per roll
Activated Carbon Filter	
Remove and replace trays	1.5 minutes each tray
Electronic Air Cleaners	
Agglomerator type: See renewable Roll Media Removable Collection Unit:	
Remove and replace Wash in place collection chambers	4 minutes each
Wash, rinse and spray on adhesive	30 minutes each

frequently to confirm proper operation. When operating properly, the wires will be surrounded by a corona visible in the dark as a pale blue glow extending the full length of the wires. The corona is evidence of ionization and the absence of the corona may indicate low voltage or dirty wires. Short circuits will show up as arcs and tripping of the circuit breaker. Broken ionizer wires should be replaced immediately. Occasionally it will be necessary to wipe down or brush dust from ionizer wires, struts, and plates.

Time Standards for Servicing Major Filters Types

Time allowances or standard times, which can be applied with confidence to maintenance operations, are very valuable in planning and analyzing work requirements. The following time allowances are a combination of observed or experienced times for performing filter service work under average conditions. They should be attainable by any reasonably well-trained mechanic with proper tools and instructions.

Access Time Allowances

An allowance must be added to the total filter servicing time to provide time for removing fasteners, removing or opening service or access panels, wiping or vacuum-cleaning the chamber, and reinstalling panels and fasteners after servicing the filter.

Some typical access time allowances are shown below.

Other items should be calculated to add to filter changing and access time allowances to get a total picture of service time requirements for filter installations. These items include allowances for reading and zeroing

manometers, travel time to and from filter banks, material handling time, etc.

Window Air Conditioning Unit	
Remove, reinstall screws	2x5x.7 min. = 7.0 min.
Remove, reinstall panel	2x1x1.8 min = 3.6 min.
Vacuum interior of unit	1x5.5 min = 5.5 min.
	total time = 16.1 min.
Package Air Conditioning Unit, 3-9 tons	
Remove, reinstall screws	2x12x0.7 min. = 16.8 min.
Remove, reinstall panels	2x2x1.8 min. = 7.2 min.
	total time = 24.0 min.
Package Air Conditioning Unit, 10-49 Tons	
Remove, reinstall screws	2x12x0.7 min. = 16.8 min.
Remove, reinstall panels	2x2x2.6 min. = 10.4 min.
	totl time = 27.2 min.
Perimeter Baseboard Fan Coil Unit	
Lift, reclose panel	2x1x1 min. = 2.0 min
Overhead Plenum Chamber (from Ladder)	
Remove, reinstall screws	2x6x0.7 min. = 8.4 min.
Remove, reinstall panels	2x1x8.9 min. = 17.8 min.
Vacuum chamber	1x6.0 min. = 6.0 min.
	total time = 32.2 min.

Modifying and Upgrading Filter Systems

Many existing filter systems were designed for different purposes than those for which the conditioned spaces are now being used. Codes and requirements have changed. Certainly, awareness of the costs associated with energy and maintenance practices affecting consumption and conservation has been heightened. For any number of valid reasons, engineers today are taking a second look at their filtration systems to determine

whether a modification is feasible to lower costs, upgrade air quality, or both.

A look at some recent case histories will illustrate the possibilities.

Case 1 - An Industrial Plant

The typical air handler plenum had a filter section measuring a nominal 4' high x 8' wide, and was covered with Roll Renewable media. The upgrading consisted of replacing the filter section with holding frames for 24" x 24" x 4" extended area (pleated) filters. Although both the original and replacement media are rated as medium efficiency (20 to 30 percent) by ASHRAE 52-76 standards, the replacement filters are 300 percent as efficient on small particles in the 5 to 10 micron range.

Consequently, coil cleaning has been reduced from two times per year to once per year longer. Labor to change filters has been decreased from 1.5 manhours per change to 10 minutes. Filter media cost is a standoff. List price for eight filters 2'X 2'X 4" comes to a few dollars less than the roll. Frequency of changes is slightly less.

Total results: Improved efficiency, lower cost of labor in both filter servicing and cleaning, and lower resistance to the fan, which could lower energy costs.

Case 2 - A large bank building

The main air handling units are provided with an oversize filter bank of non-supported bag filters, which have an average of 50 percent dust spot efficiency. The design velocity was less than 500 cpm at the filter bank, The engineering staff was expecting to experience two to three changes of filters per year at 1-

w.g. final resistance. Instead, the first year of



occupancy will see most filters changed only once at 0.80" w.g. The main factors appear to be a conservative design of the filter system and an excellent program of housekeeping in the building, preventing the expected accumulation of dust. The housekeeping program includes daily vacuum cleaning of all the traffic areas of the carpets, which are very high quality, tight woven construction. Very little of the usual "fuzz" from the top fibers of the carpet has been seen during the initial wear-in period.

The engineering staff is planning to add 2-pleated disposable filters in front of the bag filters when changed. This will extend the life of the bag filters at very little expense in labor and materials since the prefilters will be very easily changed and are expected to cost \$4.00 each, versus \$17.00 each for the bag filters.

What to do when Filtration has not been Maintained

Results of a poor service program are expensive and easily traced from maintenance records. It includes dirty coils, poor heat transfer with resulting high energy bills, freezing of direct expansion coils, fire hazards in distribution system ducts and

registers, dirt spills at registers and diffusers, etc.

The correction requirements are all many times as expensive as a good service program. Some of the obvious corrective measures are:

- o ***Cleaning coils and plenum chambers***

With a flashlight, determine the extent of residual dirt and fouling on the coils. Dust can be removed by brushing, vacuuming, or blowing with compressed air (and then vacuum-cleaning the settled dust). Oily residue, biological contaminants, and fungus will require chemical cleaning. A number of good chemical cleaning products are available for use a pressure sprayer, which will remove fouling contamination and leave coils bright without damaging the metal surfaces. Rinsing is not generally required. Plenum surfaces should be brushed or vacuum-cleaned to remove all loose dust and debris.

- o ***Cleaning ductwork, registers, and grilles***

Heavily contaminated air distribution systems constitute a real challenge. Seldom is enough of the ductwork available for conventions vacuum cleaning to remove accumulated dust. The most successful method is to put throwaway filters over openings and to blow the dust downstream with high volume blowers, collecting it with the filters at diffuser and register openings. Dampers may be closed to section off parts of the system so that blowing and collecting will be limited to only a part of the system at a time. Heavily soiled registers and grilles should be cleaned with the same solution as the coil cleaner.

- o ***Cleaning ceilings and walls near conditioned air units***

Try cleaning first with a portable vacuum cleaner, using a soft bristled brush tool on the end of the wand. If smears result or the area

will not come clean, use a neutral detergent solution and a damp cloth. Heavily soiled walls should be washed from the bottom up to avoid streaking. Flat paint on walls may not be possible to clean satisfactorily and may require repainting, but a clean surface is required prior to painting.

Conclusion - The Payoff

The benefits of a good air filtration service program are definitely worth the investment of management time to get it established and followed through to successful implementation.

- o Enhanced building appearance - This definitely affects marketability of tenant space and suitability for other types of occupancy.

- o Energy savings - through reduced resistance to air flow, permitting lower fan speed, and resulting in lower horsepower requirement at design air volume.

- o Improved air quality - Occupants of the building always benefit from reduction in the carried over contaminants in the building's conditioned air.

Labor savings - A good filtration service program will reduce the time to change filters, clean coils and ductwork, and reduce corrective work requirements. Servicing on a rational, planned basis always saves over breakdown or catch-up-type programs.

Cartridge Filter Systems: Procedure for Cleaning and Maintenance



How to Read an Oil Can

by Ray Thibault

Just like nutrition facts printed on the label of every item in a grocery store, the symbols on a can of motor oil tell consumers the service rating and certification for that product.

In the United States, the American Petroleum Institute (API) administers the licensing and certification of engine oils through a system that meets the warranty, maintenance and lubrication requirements of original equipment manufacturers. OEMs, oil marketers, additive companies and testing laboratories work together to establish engine oil performance requirements, test methods and limits for the various classifications and testing processes.



The system includes a formal licensing agreement executed by lubricant suppliers with API. Through this program, API has standardized the labeling of engine oils by adopting the donut logo (Figure 1). The logo was designed to be placed in a prominent position on a variety of lubricant quart/liter containers. API has also developed a starburst certification mark to select engine oils that meet the gasoline performance standards established by the International Lubricant Standardization and Approval Committee (ILSAC). This logo is displayed on the front

of licensed motor oil product packages.

To protect the consumer, API requires that all lubricant suppliers using the API Service Symbol obtain a license to use the symbol and sign an affidavit stating that test data is available to support performance claims.



Many changes with motor oil have occurred recently. The ILSAC GF-3 rating is in place but there remain concerns regarding the rocker arm sludge and piston varnishing tests to be resolved over the next few months. The SL category will be licensed by July 1, 2001, a year later than expected.

Ford and Honda recommend a viscosity of 5W-20 oil on 2001-model cars. The rest of the manufacturers recommend 5W-30. Work has already begun on GF-4 oils for a mid-2003 implementation. New and tighter emissions requirements will affect the new oils. There is concern over the level of phosphorous in the antiwear package (ZDDP) in the oils affecting the catalytic converters. This has to be balanced with the wear protection of the oils provided by the additive.

Motor Oil Properties

Motor oils, unlike industrial oils, operate in

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Motor Oil Properties

Motor oils, unlike industrial oils, operate in a severe environment and must be developed with unique properties. The primary functions of motor oil are:

- Lubricate engine moving parts to reduce friction and prevent wear.
- Clear engine of contaminants.
- Seal piston and liner for optimum engine efficiency.
- Resist high temperature degradation.
- Promote low temperature lubrication.
- Lubricate over a wide temperature range.

On the average, typical motor oils contain 18 percent additives in 82 percent basestock. New oils are faced

with tougher requirements, a trend sure to continue. In response, basestock quality must continue to improve. Most new oils require Group 2 basestocks. In addition, additive technology will be challenged to meet tough standards.

Viscosity

The most important property of any oil is its viscosity, which is defined as its resistance to flow due to internal friction. The two major viscosity measurements used in engine oils are kinematic and absolute. Kinematic viscosity (KV) is oil's resistance to flow and shear by the forces of gravity and is typically expressed in centistokes (cSt) or mm/sec². Absolute viscosity is defined as oil's resistance to flow and shear and is expressed as centipoise (cP). It is not influenced by the oil's specific gravity. The relationship between kinematic and absolute viscosity is expressed as:

Kinematic Viscosity Measurement



- Low shear rate
- Precise with 0.35 percent repeatability
- Viscosity normally determined at 40°C and 100°C (104°F and 212°F)
- Measuring time for a known volume to flow through capillary tube (efflux time)

(Figure 3)

Viscosity is determined by units expressed as centistokes (cSt) or mm/sec²

Absolute Viscosity

Absolute viscosity typically uses rotary viscometers to measure the torque on

rotating spindle to measure a fluid's shear resistance. The Cold Cranking Simulator (CCS), Mini-Rotary Viscometer (MRV), Brookfield Viscometer and Tapered Bearing Simulator are all rotary viscometers. Changing rotor (spindle) dimensions, the gap between the rotor and stator wall and the speed of rotation can change rate of shear. The units of absolute viscosity are expressed as centipoises (cP).

SAE J300 Viscosity Classification

The Cold Cranking Simulator test has excellent correlation with engine cranking data at low temperature. All values are expressed as centipoises (cP). Oils cannot exceed the maximum value to qualify as a particular weight grade. For example, oil classified as 10W cannot exceed 3,500 cP of viscosity at -20°C.

The Mini-Rotary Viscometer test is run under a low shear environment. Slow sample cooling is the sample's key feature. This correlates with the pumpability properties of oil.

To qualify for a particular viscosity weight classification, oil must not exceed 60,000 cP for a designated temperature.

Kinematic viscosity measurements are run at 100°C (212°F). Oil with a W designation must achieve a minimum viscosity in cSt. Oil with no W designation has to fall within a minimum and maximum range; 40-weight oil must have a minimum viscosity of 12.5 cSt at 100°C (212°F) and must be less than 16.3 cSt.

Oil must be able to withstand high temperature and high shear conditions. This is achieved with the High Temperature, High Shear Viscometer Test.

To qualify as a particular SAE grade, an oil must achieve a minimum viscosity at high shear and high temperature conditions.

Multigrade Oils

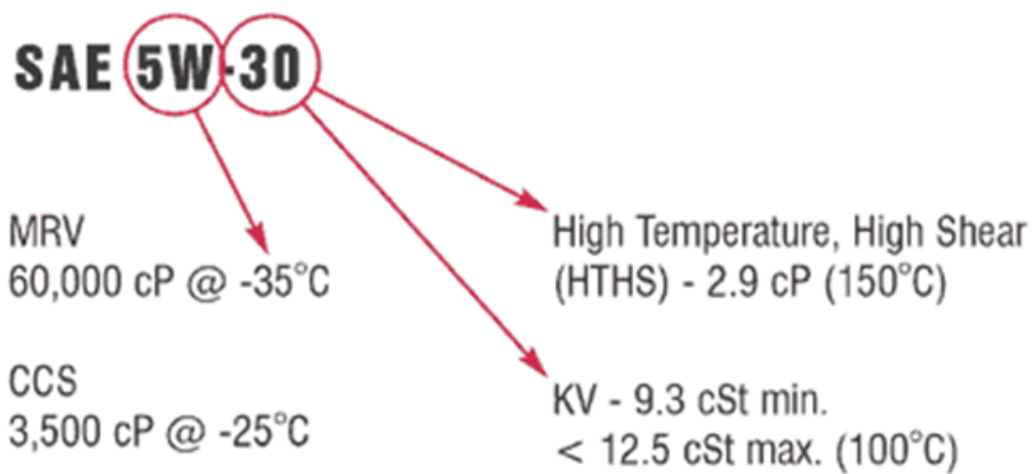
How does motor oil have good low temperature flow properties and give the protection necessary at high engine operating temperatures? This is achieved by having a high Viscosity Index which is defined as an empirical number indicating the degree of change in viscosity within a given temperature range. A high VI indicates relatively small change in viscosity with temperature change, whereas a low VI reflects a larger viscosity change with temperature. Most mineral oils range in VI from 0 to 100. Synthetics (used in motor oil) and hydrocracked stocks usually have VI temperatures exceeding 100.

Achieving the high Viscosity Indexes required by modern motor oils has been accomplished by adding VI improvers to create multigrade oils such as 10W-30. The W signifies winter and is the oil's low temperature characteristics, while the higher number gives the oil's high temperature viscosity properties. A 10W-30 oil behaves as 10-weight oil at low temperatures but gives the protection of 30-weight oil at the high engine operating temperatures. Viscosity Modifiers or VI improvers are high molecular weight polymers that remain inert at low temperatures. As oil is heated, they expand to help the oil maintain its viscosity.

Low viscosity base oil fortified with viscosity modifiers can perform well at low temperatures. If the viscosity modifiers break down under high shear conditions, the oil offers impaired protection at high engine

temperatures. The development of shear stable viscosity modifiers has improved significantly over the years.

Consider Figure 4 before oil can be classified as 5W-30.



The oil must have properties of both low and high temperatures to satisfy modern gasoline engine requirements.

Conclusion

- Gasoline engine oils are classified under the API and must meet all requirements to receive the certification demonstrated on oil containers.
- Motor oils must perform under difficult environments in both low and high temperature conditions.
- New environmental regulations will require new types of engine oil formulations.
- Emission regulations and fuel economy will require oils to be lighter in weight and to contain different additives to minimize catalyst damage.
- Basestock improvements and new additive technology will be needed to meet future stringent environmental regulations.
- Lube basestock and additive suppliers have met the challenge and will continue to do so.

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Kenken Puzzle Answer

¹ 1	^{10x} 2	5	¹⁻ 4	²⁻ 6	³⁻ 3
³⁺ 2	1	^{2÷} 3	5	4	6
^{20x} 5	^{2÷} 3	6	^{3÷} 1	^{2÷} 2	⁴ 4
4	6	² 2	3	1	⁶⁺ 5
^{2÷} 6	^{20x} 5	4	^{6x} 2	3	1
3	⁴ 4	⁵⁻ 1	6	³⁻ 5	2

TEST YOUR OPERATOR IQ ANSWERS

Answers: 1) a 2) d 3) c 4) b 5) b



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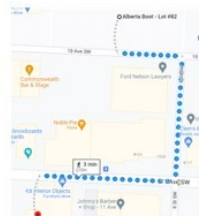
David Lamarre, P.Eng., Associate, Exel Systems Inc. **3pm - 4pm**
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Bio: Arvin graduated from University of Calgary with Mechanical Engineering and has been employed with Engineered Air for 7 years. He was working in Saskatchewan Sales for the last 5 years before transferring to Calgary Sales in August.

Sean graduated from Carleton University in Bachelors of Mechanical Engineering. Worked in several other mechanical firms in Ontario and moved to Calgary to work for Engineered Air, over 16 years ago. Sean has been in the Calgary Sales for 15 years now and has done well over 200 replacement unit/coils throughout that time.



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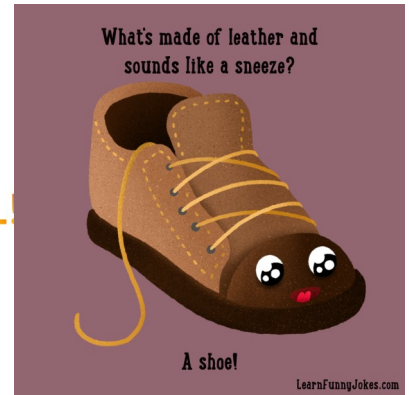
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What's the difference between a hippo and a Zippo?

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RD



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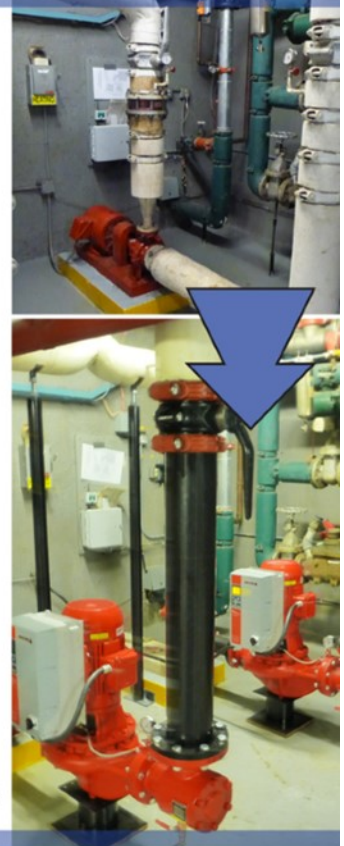
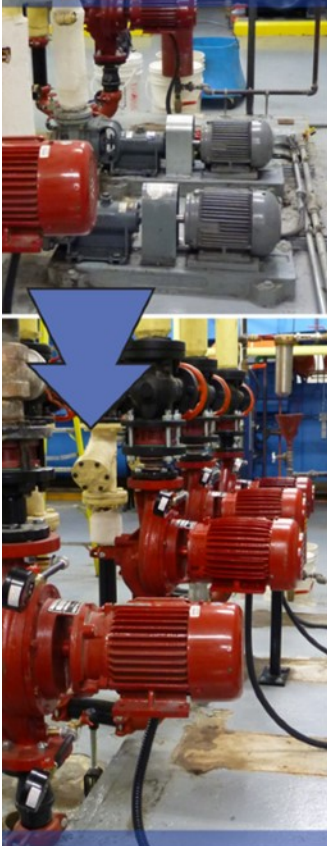
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