KAYDON FILTRATION

POWER GENERATION

Steam, Combustion and Hydroelectric Facilities

EXTENDING YOUR ENERGY

For the past 70 years Kaydon Filtration has provided innovative fluid conditioning solutions across the globe for power generation companies. For each project we offer products, expertise and experience in conditioning oils and fluids to keep your plant operating at peak performance.

KAYDON FILTRATION

In order to achieve **long-term, predictable and profitable** performance for your power plant equipment, Kaydon Filtration technologies keep contamination out.

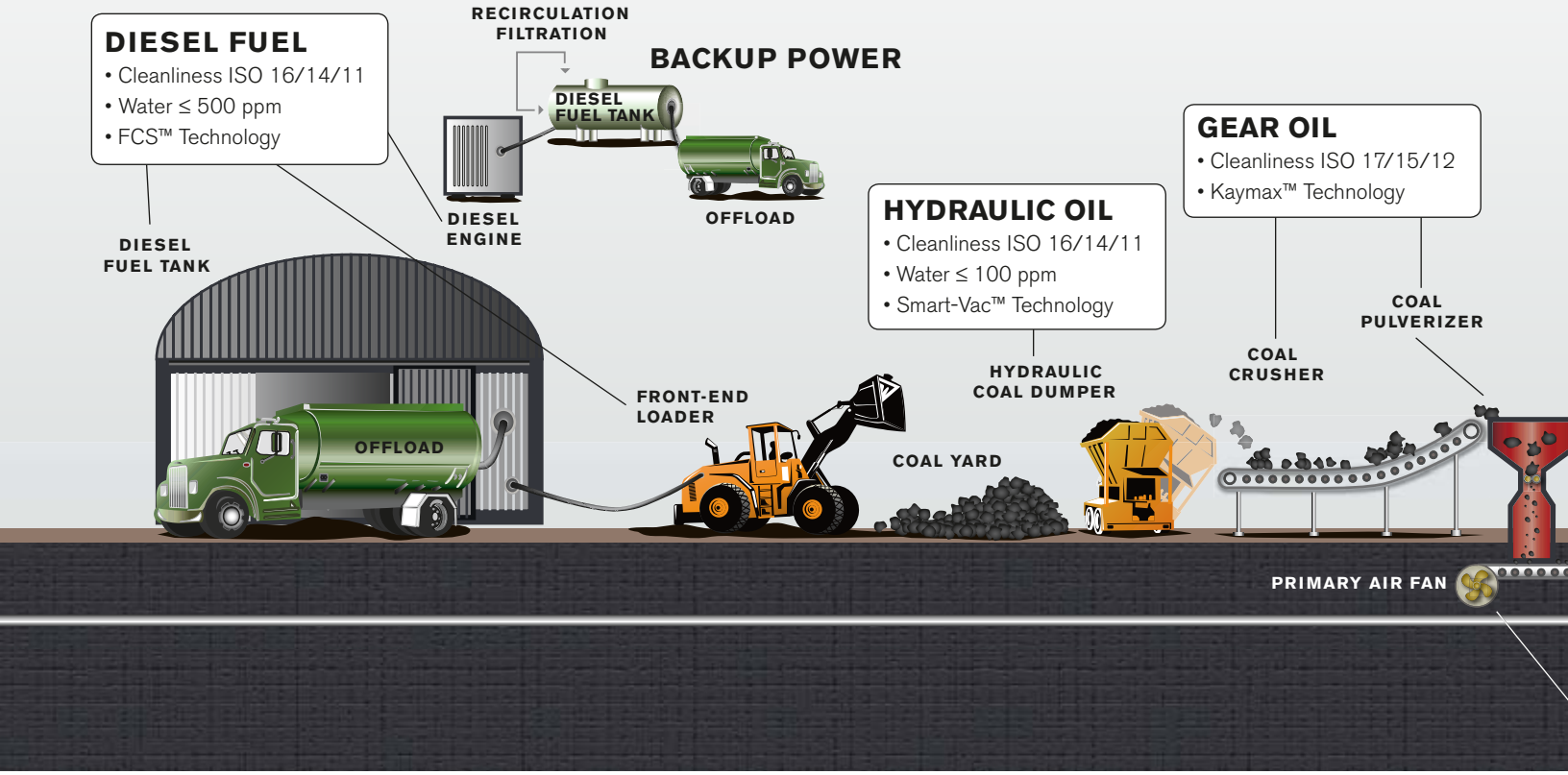
The need for clean, dry oils and fluids is a necessity for long-term power plant equipment reliability. Kaydon Filtration understands that downtime is the ultimate enemy of power plant equipment and as a result has developed application specific filtration technologies to minimize downtime and maximize performance for steam, combustion and hydroelectric power plants.

The fact that turbine manufacturers worldwide depend on Kaydon Filtration to keep their turbines functioning properly is a testament to our experience and expertise.

Every phase of your plant's operation has specific needs that Kaydon Filtration understands. From super-clean turbine oil and varnish free components, to ultra-dry transformer oils, Kaydon Filtration can provide a solution to meet your demanding and varied oil and fluid conditioning needs. In the end, we offer more than long-term, predictable and profitable performance for your plant equipment; we offer assurance that your plant stays online.

STEAM TURBINES

With steam turbine equipment operating in high-temperatures and high-humidity environments, water can quickly contaminate your lubricating oils. Recent studies have shown that water content of 200 ppm and above can reduce bearing life by as much as 50%[1]. Kaydon Filtration technologies offer solutions that can reduce water content to less than 100 ppm in a single-pass[2] thereby giving you the maximum bearing and journal life for your steam powered turbines.



Kaydon Filtration specializes in keeping oils and fluids in your steam turbine plant clean and dry. We have technologies to support oil and fluid conditioning in steam turbine units ranging from 1 to 1,000 MW.

Our optimized turbine oil conditioning systems with Kaydon Filtration's patented Turbo-TOC® coalescing technology are specifically geared to protect the:

- Main turbine system
- Boiler feed pump
- Primary, forced draft, and induced fans
- Fluid drive

The technologies Kaydon Filtration has developed for steam power plant oil, fluid, and fuel conditioning applications include:

- Turbo-TOC® Technology for single pass[2], high flow water removal in turbine oil
- Smart-Vac™ Technology for electro-hydraulic control fluid, hydraulic oil, and transformer oil
- Kaymax™ Technology for maximum cleanliness levels in lubricating fluids
- BCA™ Technology for sub-micron (varnish) particulate removal
- FCS™ Technology for conditioning diesel fuels during off-load, storage, and fueling

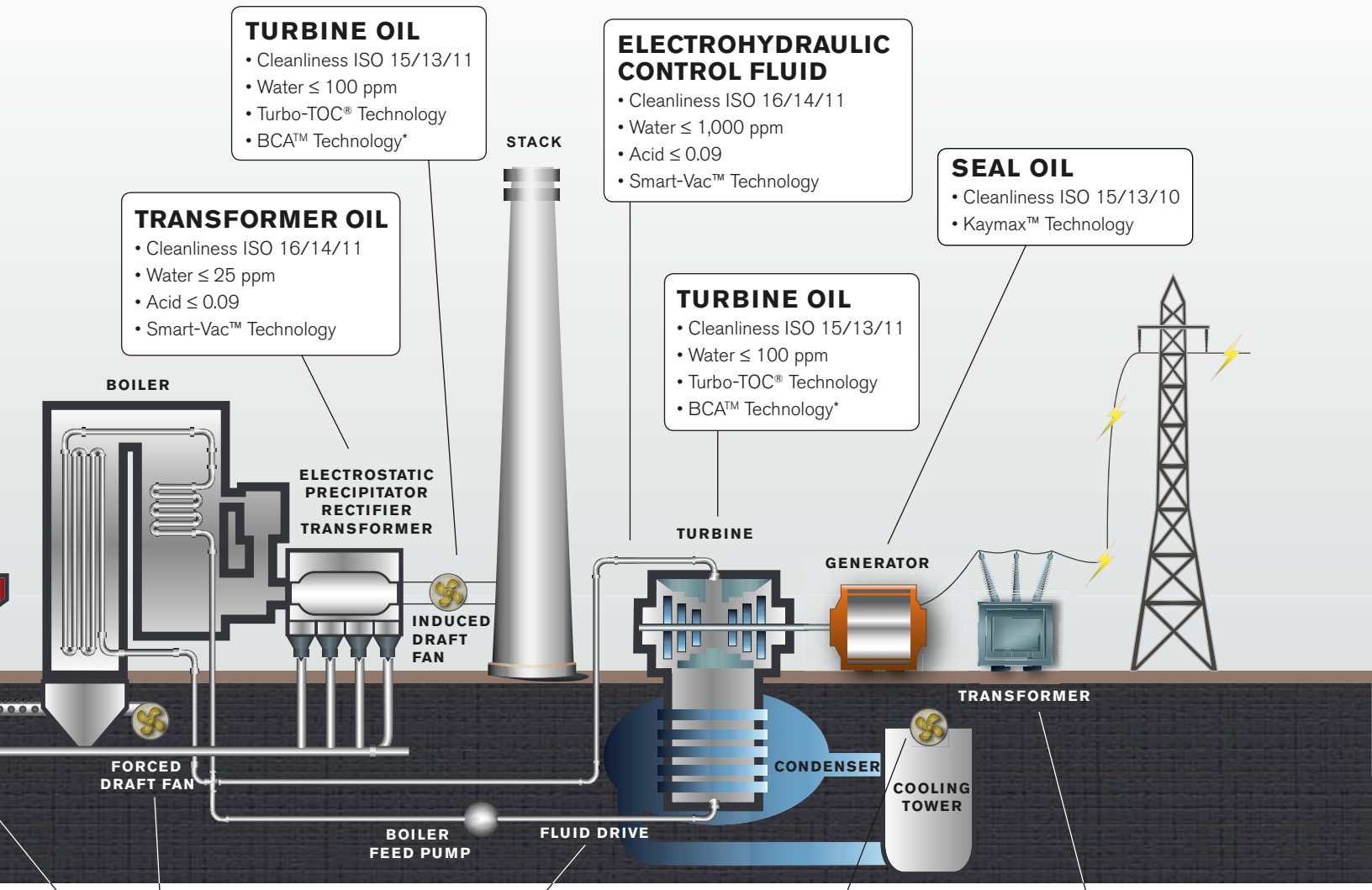
Our primary oil condition systems combine particulate and water removal into a single skid mounted, completely automatic solution with processing rates exceeding 100 GPM (380 LPM) with total water removal to less than 100 ppm and an ISO cleanliness level to 15/13/11 or better. These systems continuously condition turbine oil reservoirs during turbine operation and during scheduled down times.

Not only does proper oil condition keep your turbine systems up and running, it also ensures your turbines and equipment come back online easily and in the shortest time after shutdown.

Kaydon Filtration technologies are used around the world to help power plants to:

- Keep steam turbines on-line longer
- Make downtime scheduling more predictable
- Meet peak demand requirements
- Reduce maintenance and replacement costs
- Extend lubricant life

KAYDON FILTRATION



Kaydon Filtration also offers fluid conditioning systems to effectively purify other fluids and lubricating oils used in your power plant:

- Hydraulic oil
- Gear oil
- Seal oil
- Transformer oil
- EHC fluids

Maintaining these utility system oils, lubricants, and fluids in top condition not only increases their useful life but it also reduces unscheduled maintenance and pre-mature equipment failure.

In addition to turbine and lubrication oils, Kaydon Filtration offers conditioning technologies and systems to protect your diesel fuel during offload, storage, and distribution. Diesel engines used in modern heavy equipment, backup power generators, and other diesel powered operations require clean, dry fuel more than ever.

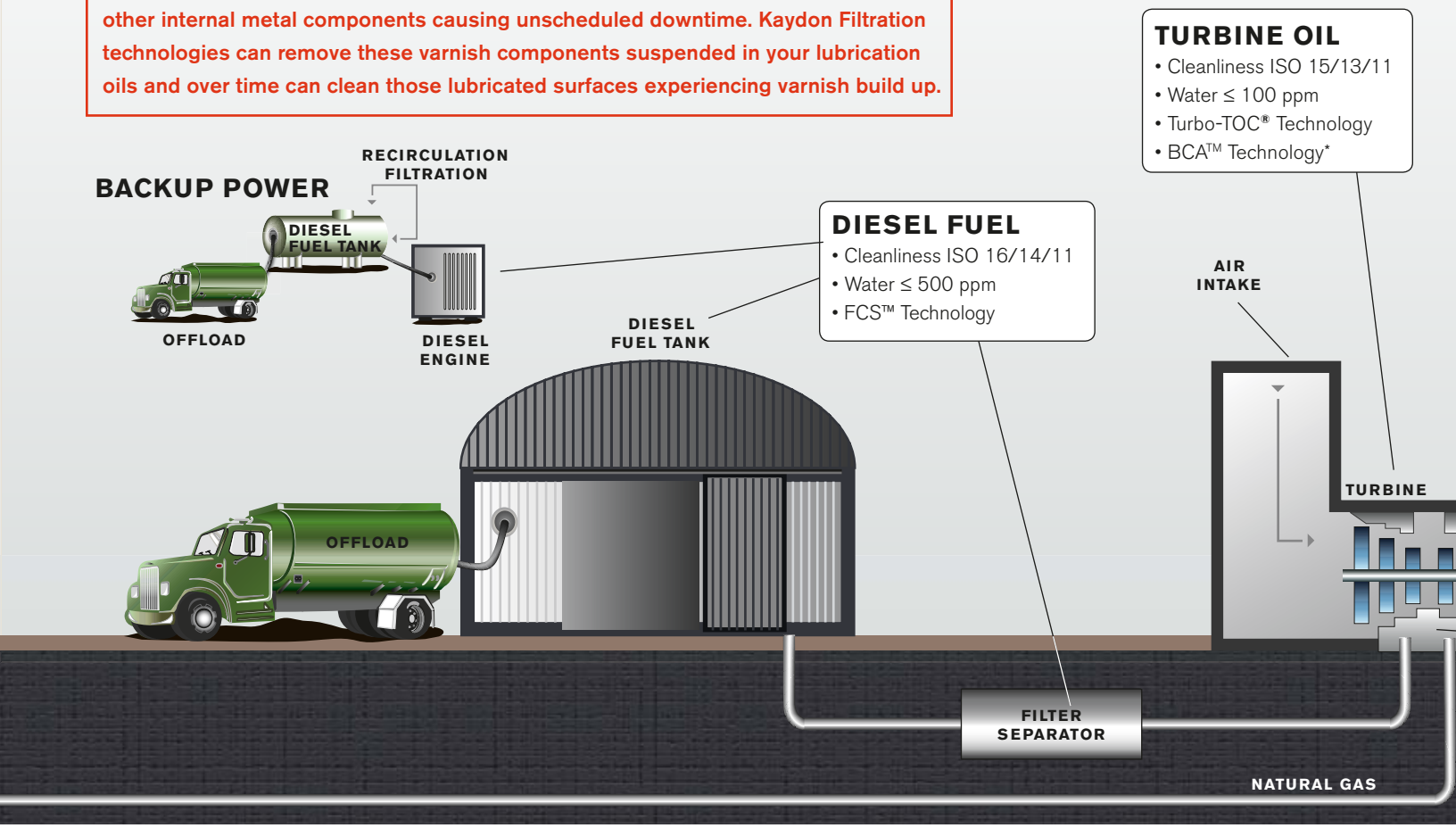
Diesel engines with high pressure injection systems[3] can have on-board filters easily overwhelmed by contaminated fuel resulting in:

- Unscheduled maintenance
- Power loss
- Decreased fuel efficiency
- Injector and high-pressure pump failure
- Expensive down time

Kaydon Filtration has the experience and technology to keep critical application diesel powered equipment up and running.

COMBUSTION TURBINES

Power plants using combustion turbines face unique challenges for oil and fluid contamination. Beyond the traditional turbine oil contaminates of dirt and water, sub-micron particles (varnish) can adversely affect the operation of servo valves and other internal metal components causing unscheduled downtime. Kaydon Filtration technologies can remove these varnish components suspended in your lubrication oils and over time can clean those lubricated surfaces experiencing varnish build up.



Kaydon Filtration specializes in keeping oils and fluids in your combustion turbine plant clean and free from varnish and other harmful contaminates. Our solutions and technologies support oil and fluid conditioning in combustion turbine units ranging from 1 to 500 MW.

Contamination in combustion turbine lube oil systems can:

- Reduce oil viscosity
- Accelerate oil degradation
- Damage bearing and journal surfaces
- Trip system shutdown
- Cause unscheduled downtime

Keeping the turbine online, reducing failure rates, increasing time between repairs, and ensuring successful turbine lube oil system inspections are areas where Kaydon Filtration can provide help. Kaydon Filtration has extensive experience with keeping combustion turbine systems operating reliably and free from damaging lubrication contaminants.

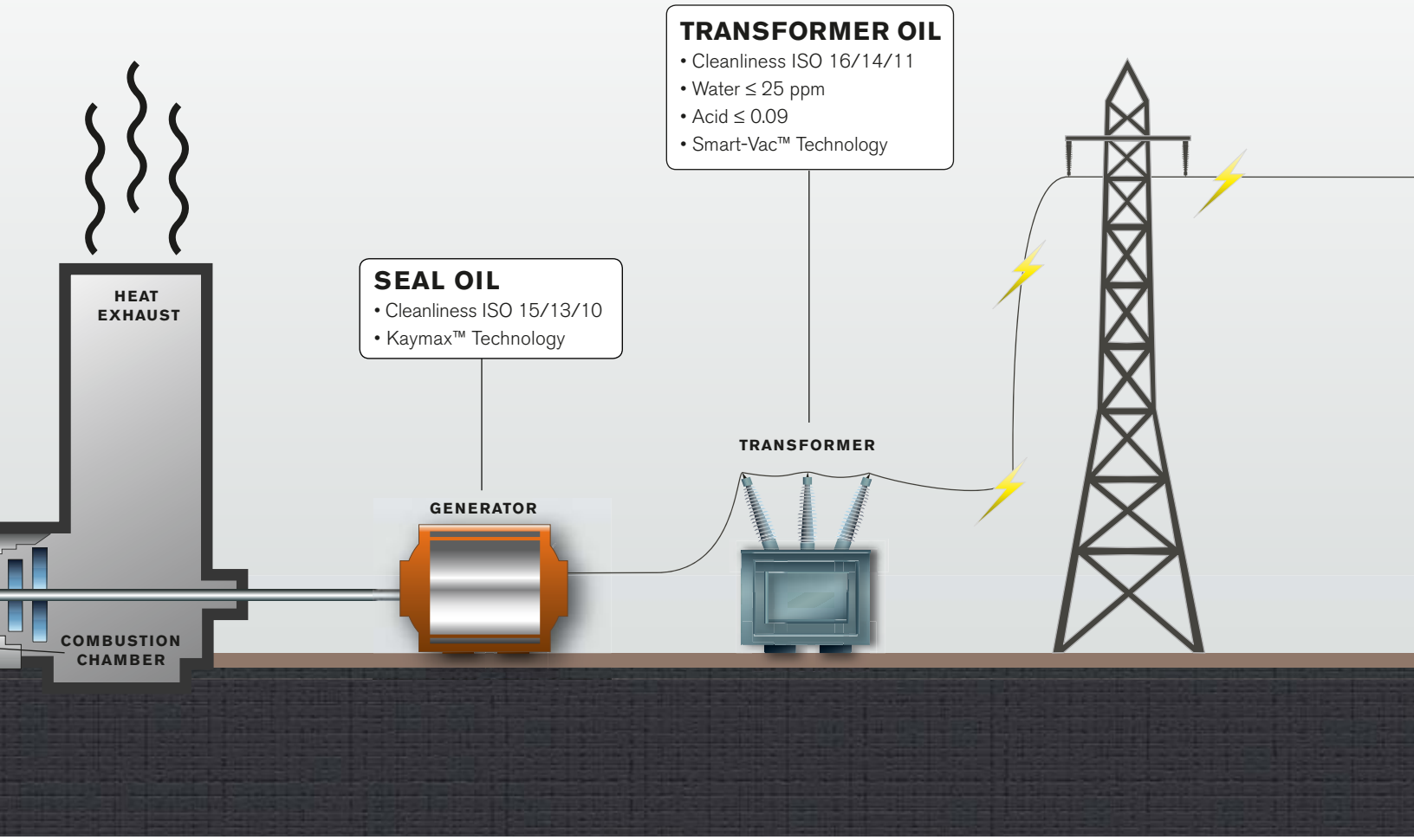
The technologies Kaydon Filtration has developed for combustion power plant oil, fluid, and fuel conditioning applications include:

- Kaymax™ Technology for maximum cleanliness levels in lubricating fluids
- BCA™ Technology for sub-micron (varnish) particulate removal
- Turbo-TOC® Technology for single pass, high flow water removal in turbine oil
- Smart-Vac™ Technology for hydraulic oil and transformer oil
- FCS™ Technology for conditioning diesel fuels during off-load, storage, and fueling

Kaydon Filtration technologies provide cleanliness levels to ISO 15/13/11 or better for your turbine oil and maintains water contaminates to 100 PPM or less. BCA™ Technology when used in conjunction with our Kaymax™ Technology can further increase your turbine reliability by eliminating sub-micron varnish producing contaminates that build-up on internal metal surfaces.

Our optimized turbine oil condition solutions and technologies are specifically geared to protect:

- Main turbine system
- Servo valves
- Heat exchangers
- Bearing and journal surfaces



Kaydon Filtration also offers fluid conditioning systems to effectively purify other fluids and lubricating oils used in your power plant:

- Seal oil
- Transformer oil
- Hydraulic oil
- Gear oil

Maintaining these utility system oils, lubricants, and fluids in peak condition not only increases their useful life but it also reduces unscheduled maintenance and pre-mature equipment failure.

In addition to turbine and lubrication oils, Kaydon Filtration offers conditioning technologies and systems to protect your diesel fuel during offload, storage, and distribution. Diesel engines used in modern heavy equipment, backup power generators, and other diesel powered operations require clean, dry fuel more than ever.

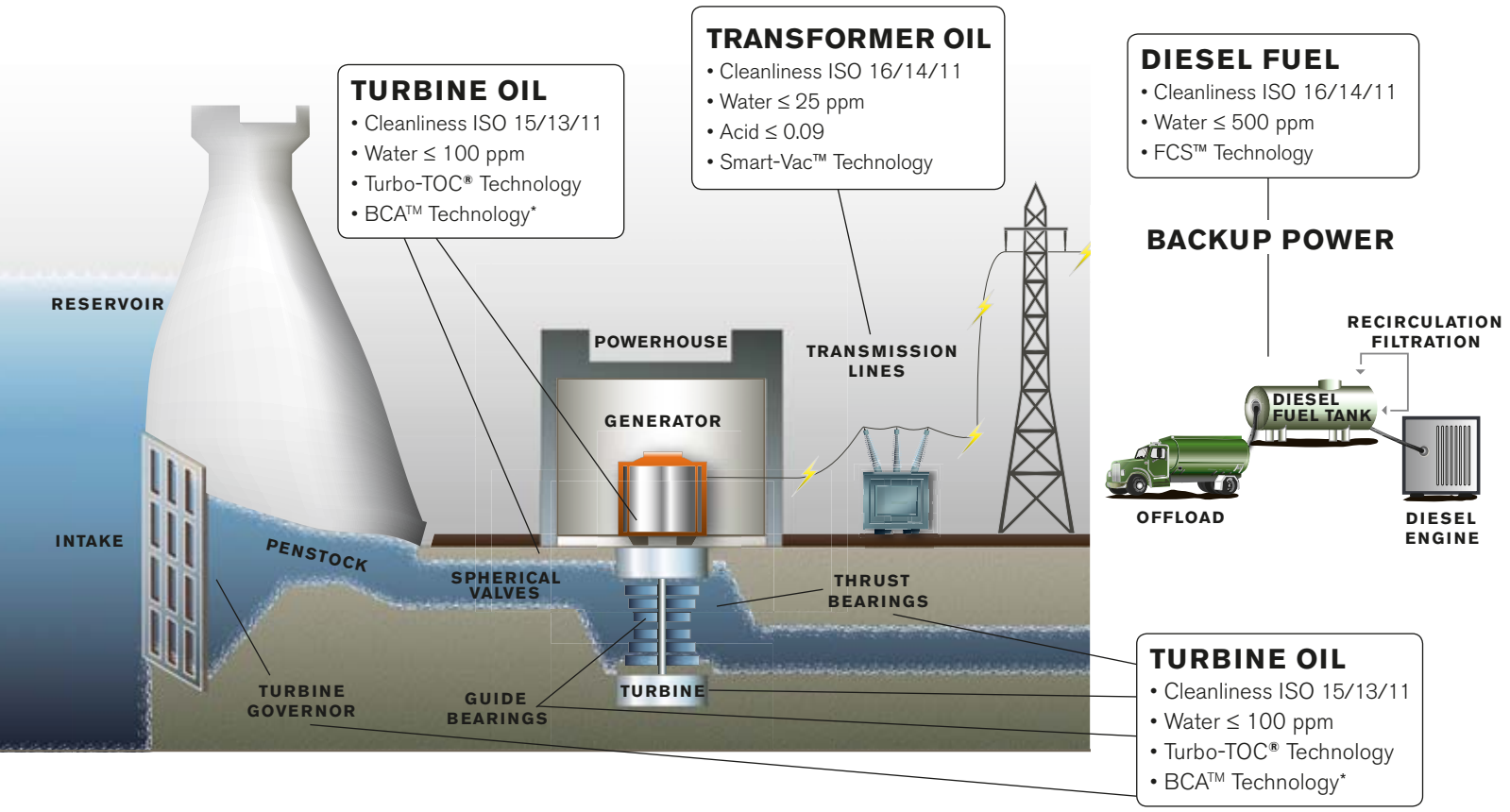
Diesel engines with high pressure injection systems[3] can have on-board filters easily overwhelmed by contaminated fuel resulting in:

- Unscheduled maintenance
- Power loss
- Decreased fuel efficiency
- Injector and high-pressure pump failure
- Expensive down time

Kaydon Filtration has the experience and technology to keep critical application diesel powered equipment up and running.

HYDROELECTRIC TURBINES

Failures of the wicket gate mechanism, turbine governor, and turbine bearings are among the top 25 causes of forced outages[4] within a hydroelectric facility. Through improved fluid management and conditioning these failures can be significantly reduced.



Whether you use reaction or impulse turbines, keeping your oils and lubricants clean and dry is critical to your uptime, ability to schedule maintenance, and protection of expensive equipment. Kaydon Filtration technologies and solutions can be sized to support hydroelectric units from 1 to over 1000 megawatts.

Our patented technologies effectively:

- **EXTEND** the service life of lubricating fluids
- **PROTECT** expensive equipment
- **REDUCE** premature failures

The elimination of water, particulates, varnish, and other harmful contaminates from lubricating oils and fluids is Kaydon Filtration's expertise and we have been helping hydroelectric power plants worldwide in protecting their equipment investments.

Our solutions can be used to protect:

- Turbine governors
- Spherical valves
- Guide bearings
- Thrust bearings
- Lift pumps
- Transformers

The technologies Kaydon Filtration has developed for hydroelectric power plant oil, fluid, and fuel conditioning applications include:

- Turbo-TOC® Technology for single pass, high flow water removal in turbine oil
- Kaymax™ Technology for maximum cleanliness levels in lubricating fluids
- BCA™ Technology for sub-micron (varnish) particulate removal
- Smart-Vac™ Technology for hydraulic oil and transformer oil
- FCS™ Technology for conditioning diesel fuels during off-load, storage, and fueling

In addition to turbine and lubrication oils, Kaydon Filtration offers conditioning technologies and systems to protect your diesel fuel during offload, storage, and distribution. Diesel engines used in modern heavy equipment, backup power generators, and other diesel powered operations require clean, dry fuel more than ever.

Diesel engines with high pressure injection systems[3] can have on-board filters easily overwhelmed by contaminated fuel resulting in:

- Unscheduled maintenance
- Power loss
- Decreased fuel efficiency
- Injector and high-pressure pump failure
- Expensive down time

Kaydon Filtration has the experience and technology to keep critical application diesel powered equipment up and running.

Kaydon Filtration technology quickly and efficiently removes damaging water.

Turbo-TOC® Technology

Kaydon Filtration patented Turbo-TOC® coalescing technology keeps turbine rotating components protected by providing quick and efficient water removal from turbine oil. Studies have shown that bearing life can be reduced by 50% with water contamination of 200 ppm when compared to oils conditioned to 100 ppm[1]. As a result, our Turbo-TOC® technology was developed to remove water to less than **100 ppm in a single pass**[2] at process rates exceeding 100 GPM (380LPM).

Coalescer Element

The core component of the technology is the patented coalescer element. The coalescer element utilizes three stages to coalesce (grow together) droplets of water from turbine oil.

1st Stage: Pre-Coalescing

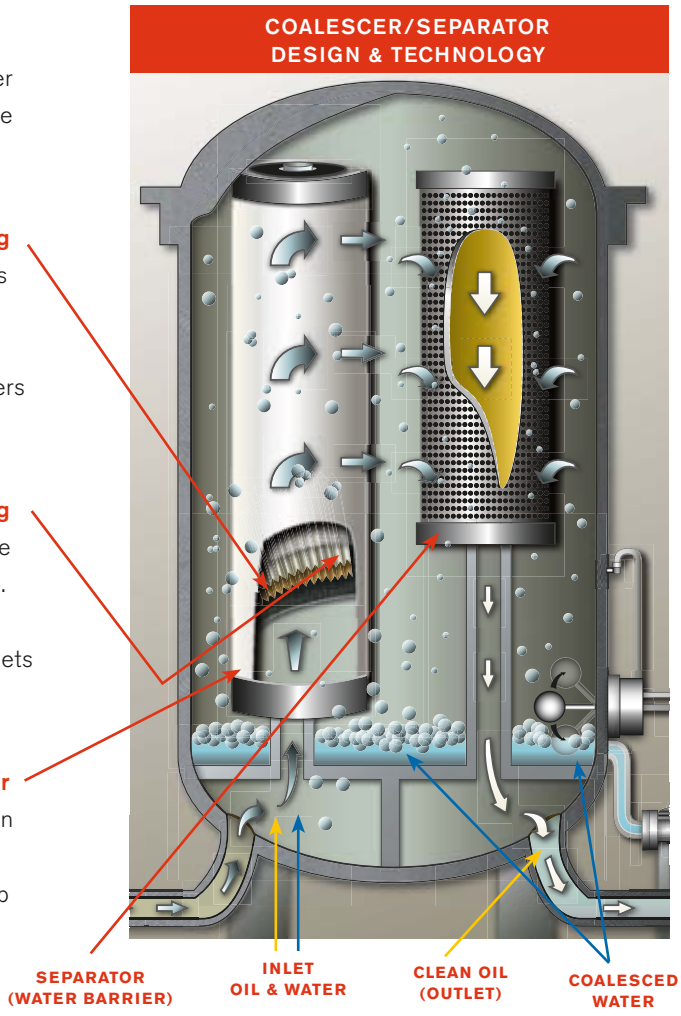
This macro-fiber stage begins the initial process of phase separation of the oil/water emulsion. Effective water collection in this stage provides easier attachment of the water to the micro-fibers in the 2nd stage.

2nd Stage: Coalescing

The pre-coalesced water droplets from the 1st stage come together on the micro-fibers of the 2nd stage. When the micro-fibers become fully saturated with water, water droplets are formed. These water droplets flow on to the 3rd stage.

3rd Stage: Drain Layer

The drain layer surface is designed to have an attraction to water and repulsion to oil. This unique surface characteristic causes the water droplets to quickly drop to the water collection area of the coalescer vessel while freely passing the oil through.



Separator Element

The final component of the technology is the separator stage. The separator provides a hydrophobic screen that acts as a water barrier to prevent smaller water droplets from flowing downstream. In addition, the separator element includes a micro-fiber component that acts as a final polishing filtration stage for particulates. This polishing affect eliminates the need for the expensive final filter stage found in traditional oil conditioning systems.

The combination of the coalescer and separator stages delivers water removal in oil to less than 100 ppm and polishing to <5 microns.

When it comes to turbine oil particulate removal, look no further than Kaydon Filtration.

Smart-Vac™ Technology

Many fluids require water removal to well below 100 ppm or because of their chemical composition render coalescing ineffective in removing water. Separation of water from oil by removing it in the form of water vapor, rather than removing it in the liquid state, is the principle used in Kaydon Filtration's Smart-Vac™ technology. In this way, water can be removed from oil without regard to the degree of emulsification. Even the most stubborn, stable oil/water emulsions can be separated.

The vacuum distillation used in Smart-Vac™ technology is different than other dehydration processes. It uses an integrated three stage process of low-temperature dehydration, disperser assisted distillation, and rapid condensing. Kaydon Filtration Smart-Vac™ systems performance delivers less than 25 ppm water content with an ISO 16/14/11 cleanliness level.

Smart-Vac™ technology allows for water removal in a number of liquids and applications that cannot be addressed through coalescing:

Electrohydraulic Control Fluid (EHC)

Smart-Vac™ technology removes water from phosphate ester fluid used with EHC systems. Combining this technology with acid removal and Kaymax™ particulate removal technology, a complete purification system is created. Acid number (AN), water content (ppm) and particulate cleanliness levels (ISO Cleanliness Code) are all three maintained within fluid manufacturer and OEM equipment specifications.

Hydraulic Oil

Water contamination in hydraulic systems causes oil degradation, reduction of oil film thickness, viscosity changes, component surface damage and corrosion. Smart-Vac™ technology provides continuous protection from water contamination in hydraulic oil, therefore safeguarding sensitive hydraulic power unit components.

Transformer Oil

Excessive water in transformer oil causes accelerated degradation of transformer insulation materials and reduction of oil dielectric strength. Because transformers depend on oil for cooling, insulation, and protection from corrosion, the removal of water in transformer oil is an essential part of transformer maintenance. Smart-Vac™ technology removes water from transformer oil to acceptable levels to protect transformers from being adversely affected by water contamination.

Kaymax™ Technology

Kaymax™ technology provides exceptional particulate filtration for oils, fluids, and fuels. Kay-Max™ technology combines meticulous filter media selection and filter element construction methods to produce proven and repeatable filtration performance. Kaymax™ technology uses specially formulated multi-layered, micro-fiberglass fibers to deliver exceptional particle retention and high particle holding capacity. Kaymax™ construction helps maintain pleat integrity under high flow and high viscosity conditions, and with supporting materials, pleat bunching or collapse during high flow, high dirt loading or cold start-ups is eliminated. Construction materials are selected for proper fluid compatibility and are corrosion resistant. Kaymax™ technology performance meets or exceeds ISO 15/13/11 cleanliness level.

Turbine Oil

Kaymax™ technology is utilized with Turbo-TOC® turbine conditioning systems. The technology is a vital component of the conditioning process, and its use is instituted in the pre-filtration and polishing filtration stages of the Turbo-TOC® system. The benefits of Kaymax™ technology in the pre-filtration stage is its ability to capture larger particles and extend the life of the coalescer element. Polishing filtration removes the smaller particles and provides turbine oil cleanliness of less than ISO 15/13/11.

Gear Oil

Kaymax™ technology removes particulate contamination from gear oil, therefore protecting gearbox operation. Gear oil is susceptible to invasion of particulate contamination and the abrasive action of particulate creates mechanical wear of gearbox bearing and gear surfaces. Prevention of mechanical wear can be attained through the use of Kaymax™ technology equipment. The benefits of removing mechanical wear producing particulates are a reduction of bearing and gear failures, prevention of downtime and a decrease in maintenance costs.

Seal Oil

Kaymax™ technology protects seal oil from particulate contamination. Particulate contamination in the seal oil system causes abrasive wear that may require shaft repair or replacement of seal rings. Gland seal wear caused by particulate contamination can cause shaft sealing failure, which will permit hydrogen to escape from the generator. Prevention of seal oil system failure can be attained through the use of Kaymax™ technology equipment. The benefits of removing particulates from seal oil are prevention of shaft and seal wear and prohibits hydrogen leakage.

Kaydon Filtration technologies help decrease unwanted downtime by extending equipment life.

BCA™ Technology*

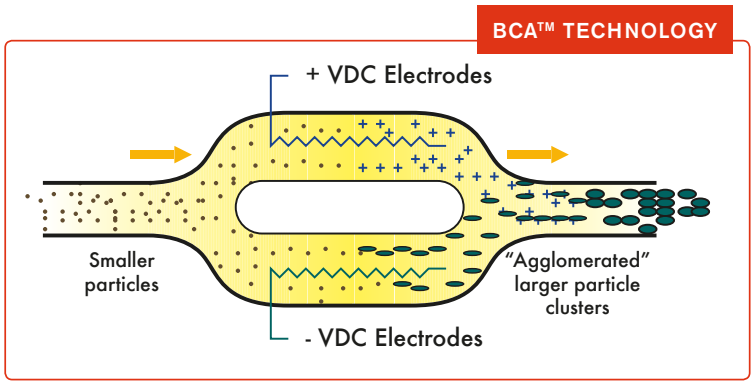
BCA™ Varnish Removal Technology is the process of inducing an electrical charge within an oil flow path to manipulate sub-micron particles to become negatively or positively charged. These oppositely charged particles experience attraction called "Agglomeration." These agglomerated particles become large enough for Kaymax™ filter elements to capture them. Over time this ultra conditioned oil will clean those lubricated surfaces experiencing varnish build up.

Steam Turbine Lube Oil

Steam turbines usually do not show immediate problems with varnish, but will after several years of service. During this time varnish forms and creates a reduction in cooler performance, increases wear for bearings and journal surfaces, causes bulk oil temperatures to rise, and increases make-up oil intervals due to an acceleration of oil additive depletion. Elimination of these problems is realized by adding BCA™ technology. BCA™ technology provides reduction of bearing and journal failures, returns bulk oil temperatures to normal levels, prevents excessive cooler maintenance, and reduces oil purchases and disposal costs.

Combustion Turbine Lube Oil

Turbine lube oil color darkening, increased bearing wear rates, increased oil temperatures, sluggish valve operations, and rise in acid level are all indicators that a combustion turbine has been affected by varnish. Continual thermal degradation and diligent oxidation creates sub-micron particles that form varnish. The benefits of removing sub-micron particles that create varnish are turbine downtime is reduced, reduction of valve and rotating equipment failures, reduction of oil purchases and disposal costs, and returns lube system reliability.



FCS™ Technology

From the time diesel fuel leaves the manufacturing refinery, its transportation and storage begins the contamination process of introducing water and particulates. Each time the fuel is transferred and stored it combines and agitates with pre-deposited particulate and water already in your storage tank and the fuel becomes further contaminated.

This contamination problem becomes worse if the fuel stored is only used occasionally. Emergency power generators and other low use fuel tanks can become contaminated with condensation, microbiological growth, and oxidation by-products. The endpoint of the contamination that has been collected is the fuel tank of your vehicle or diesel powered equipment. This contamination can easily overload on-engine filters resulting in power loss, a decrease in fuel efficiency, injector and high-pressure pump failure, and expensive down time.

To effectively remove the water to levels that are acceptable to diesel engine manufacturers, FCS™ technology offers the best and most economical solution.

FCS™ technology addresses these fuel contaminants in four unique conditioning stages: pre-conditioning, coalescing, drain layer, and barrier layer. This combination of the fuel conditioning stages reduces water content in fuel at the outlet of the FCS™ Technology equipment to less than 500 ppm with a cleanliness code of better than 16/14/11.

This technology is offered in two Kaydon Filtration system configurations: in-line for single pass filtration during fuel distribution or transfer and recirculation for fuel storage tanks. Applications include:

- Tank storage
- Transfer and distribution
- Equipment refueling
- Backup power
- Combustion turbines

*BCA™ Technology is a registered trademark of ISOPUR Fluid Technologies.

[1] The Effect of Water in Lubricating Oil on Bearing Fatigue Life, Richard E. Cantley The Timken Company, Asle Transactions, Volume 20, 3 244-248

[2] Nominal results with influent at <=5000 ppm and <=18/16/13 cleanliness. Actual results may vary.

[3] The Benefits of Diesel Fuel Filtration ©Kaydon Filtration 2008

[4] Statistical information from the North American Reliability Council Kaydon Filtration specifications are subject to change without notice.

When all is said and done – lubricants, fluids, and diesel fuel are the core of your power plant equipment. Kaydon Filtration is here to keep them in peak condition.

To make sure you arrive at the solutions that are best for your application, Kaydon Filtration offers a variety of value-added services from design and testing to manufacturing, service and consulting. Whether your requirements revolve around protecting a single piece of equipment or for an entire facility, Kaydon Filtration is ready to respond with the expertise and answers you can trust.

We regularly partner with customers to tackle specialized filtration challenges. Our team of applications engineers draws on extensive knowledge in the areas of mechanical engineering and chemistry to expertly craft engineered solutions that address your particular situation both now and in the years to come. We invite you to learn more about how we are **EXTENDING YOUR ENERGY!**

KAYDON®
KAYDON FILTRATION

Kaydon Filtration Regional Office
11 / F, Tower A, Gateway No. 18 • Xianguangli North Road
East Third Ring Chaoyang District
Bejing, China 100027
Phone +86.10.5923.1200 • Fax +86.10.5923.1204

Kaydon Filtration Headquarters
1571 Lukken Industrial Drive West • LaGrange, GA 30240
International 00+1 706.884.3041 • Toll Free 1.800.241.2342 (U.S. Only)
Fax 706.884.3835 • www.kaydonfiltration.com • filtration@kaydon.com