Parallel Canister Design for Nuclear Carbon Filters Testing

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Contents

- Parallel canisters requirements
- ANSTO canister System for 2’ X 2’ X 1’ filters in 2” deep and 10” deep
- USA canisters design for 2’ X 2’ X 1’ filters
- Comparison
Adopted standards for parallel canisters tests at ANSTO

- ASTM 3803-98 Standard Test Method of Nuclear-Grade Activated Carbon
- ASME AG-1 Code on Nuclear Air and Gas Treatment
- ASME N510 -2002 Testing of Nuclear Air Treatment Systems
- ASME N509-2002 Nuclear Power Plant Air-Cleaning Units and Components
Air filter testing - Carbon Canisters

- The canisters are recommended to be installed vertically in parallel with filters. Set of six
- Carbon of canisters of the same batch as filters.
- Test carbon in a lab to ASTM 3803-98. Maximum allowed penetration 1 % Methyliodine.
- Canisters used at ANSTO are 2” and 10 “ long and all are 2” diameter.
- The airflow in the canisters must be within +/- 10% of the average airflow in the filter.
ANSTO Canister System

From Inlet of Filter to two 2” SS Pipes

Upper plenum

Air flow

Pipe 2” SS

6 Carbon Canisters

Flanges

to two 2” SS Pipes and Outlet of Filter

Air Velocity

Static Pressure

Two Points

Shut off Valves

Lower plenum

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Qualification of Canisters

• Calculations to demonstrate that static pressure losses through connection pipes are negligible
• Factory checks of flows and pressures of carbon canisters in parallel with carbon filters to validate the design
• Measure velocity through each canister to be within +/- 10% of the flow in filters. Preferred.
• Test rig to check velocity/pressure in each assembled canister. Recommended
2” Length Carbon Canister- US System

- Perforated Plate
- Threaded area
- Circlip
- Removal Tool
ANSTO Canisters

- Carbon Canister 10” long
- Carbon Canister 2” long
- Blanking Flange
- Vibratory Table
US Canisters System for 2” deep Filters Type IV size 2’X2’x1’
Canisters in Standard Type 4 Filter 2’x2’x1’

Area taken from filter to install canisters. At least 10% of filter area lost.

Remaining filter area

Six Canisters
Filter Testing Box - US

Vel Sampling = +/- 10% Vel Filter

Filter Test Box
Carbon Canister
Lid

Air Vel Filter
Carbon Filter

Pressure Point added

Slit designed. Proposed 2” Pipe, Shut Off Valve and Pressure Point.
Rear of Box is attached to the filter under test

Air Outlet Slit

Air Inlet slit

Air Flow direction

Carbon Canisters are in parallel with filter under test

Carbon Canisters are inside the box
Lid removed from Filter Testing Box- US System

- Carbon Canister
- Air Flow direction
- Install Blind Plug when removing canister
Front of Filter Testing Box - US System

Remove Lid to access Carbon Canisters

Air Flow direction
ANSTO Options to Sample Carbon to ASTM 3803-98
Direct sampling from filter

Sample container
ASTM E300-04 Standard Practice for Sampling Industrial Chemicals.

Sampling equipment used for carbon filters

**FIG. 10 Multi-Slot Tube Thief**

**FIG. 11 Single-Slot Tube Thief**
Mark 2 Six Canister ANSTO Design
Mark 2 ANSTO 10” Long Canister

- Canister and Pipe 2” Diam
- 2” Ball Valve
- Two 2” Pipes Outlet Lower Plenum
- Two 2” Pipes Inlet Upper Plenum welded on site
- Upper Plenum
- Air Flow
- Canister Flow and Pressure ¼ “ Sockets
- Lower Plenum
Options to test carbon to ASTM 3803-98

• Design new systems of carbon filtration with budget for parallel canisters in mind.

Old Systems already operating

• Retrieve carbon from filters in non-active filters.
• Upgrade carbon filters with canisters pre-installed.
• Install canisters by retrofitting in existing housings. Best option.
Comparison

ANSTO system Advantages
- Access for flow and static pressure measurements
- Isolating valves allows decay of radiation on retrieval
- Canisters installed vertically preventing bypass problems
- Convenient for 10” long canisters.

US system for 2” Canisters Type IV Filters Advantages
- Low cost design
- Easy to install
- Needs to be qualified in the factory or by calculations
- Canisters to be tested in a rig before installation
- Convenient with 2” long canisters
Questions ?
Cyclotron Production
Carbon Canister modules - ANSTO System OPAL

Canisters are in parallel with Filter under test

Upper and lower plenums

Carbon Filters under test

Air flow direction

2” Canisters

1” Pipe

2” Pipe welded on site

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Copper testing manifold-ANSTO

Requires 2” BSP Socket for Installation in the Duct
Carbon for canisters

- Set of carbon filters must have a representative sample of carbon separately supplied to fill canisters. Rarely supplied.
- Solution if carbon not supplied or lost. Take carbon directly from filter to fill the canisters, refill the filter to cover the sample taken with the same carbon specifications and valid within the 5 years ASTM 3803-89 certificate.
Access for Filter Testing - ANSTO system

- Sampling Upstream
- HEPA filters
- Injection point
- Air flow
- Carbon filters
- Canisters are installed vertically
- Downstream sampling is after the fan at a single point
Access for Filter Testing - US system

- Ventilation Duct
- Inject test gas here
- Sampling Upstream of Filter
- Sampling Downstream of Filter
- Air Flow direction
- Canister Box goes on top of Filter
- Pre filter port
- Filter port