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VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies **PM_{10} and $PM_{2.5}$ Efficiency Performance** for

TYMCO Model DST-6 Dustless Regenerative Air Street Sweeper

Developed by TYMCO, Inc.
Waco, TX, USA

Registration: GPS-ETV_VR2023-03-31-DST6A

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 31, 2023
Vancouver, BC, Canada

Verification Body
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Performance Claim(s)

The TYMCO Model DST-6 Dustless Regenerative Air Street Sweeper was operated according to the vendor's specification at a speed limit of about 5 km/h in a controlled space where no water or any other liquids were permitted. No water sprays or gutter broom shrouds were used in the testing.[1]

The sweeper was delivered in its optimum balance of dry dustless operational mode while also maximizing the pick-up and removal of test material (mean size of test material is 3 microns),

The TYMCO Model DST-6 Dustless Regenerative Air Street Sweeper achieved the following:

1. A removal efficiency of test material from surface greater than 90% (90% confidence);
2. Deposit on sidewalk efficiency less than 0.16% (95% confidence);
3. Maximum concentration of PM_{10} air contamination less than 0.08 $mg \cdot m^{-3} \cdot kg^{-1}$ (95% confidence);
4. Total concentration[2] of PM_{10} air contamination less than 10.0 $mg \cdot m^{-3} \cdot kg^{-1}$ (95% confidence);
5. Maximum concentration of $PM_{2.5}$ air contamination less than 0.02 $mg \cdot m^{-3} \cdot kg^{-1}$ (95% confidence); and
6. Total concentration of $PM_{2.5}$ air contamination less than 5.0 $mg \cdot m^{-3} \cdot kg^{-1}$ (95% confidence).

[1] As listed in "Street Sweeper Efficiency Test Report – TYMCO DST – 6 dated January 20, 2006, from City of Toronto, Transportation Services, and Environmental Services.

[2] Total concentration calculated by summing the 1200 readings taken as 1-second intervals over a 20-minute period starting at about 5 minutes before the maximum reading following the sweeper's pass and divided by the kilograms of material picked up and entrained inside the hopper.

Technology Description and Application

TYMCO Regenerative Air Dustless Sweeping Technology (DST) is designed to thoroughly clean roads and streets while minimizing the release of dust into the air. The street sweeper can have a positive environmental effect by reducing the amount of materials entering the storm sewers which may otherwise end up contaminating surface waters. Additionally, removal of particulate from streets may help reduce airborne contamination by such particulate matter, particularly on windy days.

The main components of TYMCO Regenerative Air Dustless Sweeping Technology (DST) are the blower, pickup head, pressurized hopper, multi-pass cylindrical centrifugal dust separator, and particulate air filters. The closed-loop regenerative air system uses a large blower to develop airflow. The air enters a distribution manifold that runs across the pickup head, which has a discharge opening that directs a high-velocity blast of air down and onto the pavement and into the cracks releasing dirt. The air and all captured dirt and debris are then drawn out of the pickup head through a hose and directed into the hopper. An operator-controlled cylindrical broom rotating in the pickup head also assists in loosening material and releasing it into the air stream.

After the debris-laden air stream is drawn into the large hopper, the air loses velocity allowing the larger debris to fall to the bottom. A screen at the top of the hopper prevents items such as leaves, paper, cans, and rocks from leaving the hopper. The air then enters the centrifugal dust separator. The multi-pass centrifugal dust separator further cleans the air as it spins on the curved wall of the centrifugal chamber skimming off dust particles and returning them into the hopper. The cleaned air is returned through the blower to the pickup head to start the regenerative air cycle again.

A small portion of the air leaving the blower is exhausted to atmosphere so that less air enters the pickup head than is being drawn off, thus maintaining the necessary vacuum in the pickup head. Prior to being exhausted, this small portion of air is further cleaned by being first run through a bank of small cyclone pre-cleaners and then through four membrane filters that have a Minimum Efficiency Reporting Value (MERV) 16 Rating, with the ability to capture a minimum of 95% of 0.30 micron and larger size particles.[3]

[3] *The TYMCO Model DST-6 has always used Torit-Tex® filter cartridges, as declared by the manufacturer, Donaldson Company, Inc. Independent testing carried out in accordance with the American Society of Heating, Refrigeration, and Air Conditioning Engineers [ASHRAE] 52.2 testing criteria, has reportedly determined these membrane filters to achieve a MERV 16 rating with the ability to capture greater than 95% of 0.3 micron and larger particles. Previous filter manufacturer-selected testing had rated the filter cartridge's performance as the ability to capture 99.999% of 0.50 micron and larger-sized particles. This Verification Statement has been updated to reflect the declared ASHRAE 52.2 testing results.*

TYMCO Model DST-6 Dustless Regenerative Air Street Sweeper technology is engineered to allow the sweeper to perform in all types of weather conditions with no operator adjustments required.

Performance Conditions

The TYMCO Model DST-6 Dustless Regenerative Air Street Sweeper was tested at Disco Yard, Toronto over the three test days of September 27, 28, and 29, 2005. The test facility was an enclosed tent about 80m x 11m. The test material was Camel-Wite®, manufactured by Debro Chemicals and Pharmaceuticals, a calcium carbonate-based powder with a mean diameter of about 3 microns. Approximately 270 kg was applied to the test track, which consisted of two strips, 2.75m x 30m each.

The sweeper was operated by a manufacturer representative at about 5 km/h in the "dry" mode (no water spray) with the right gutter broom operating. The City of Toronto staff conducted the testing and measurement according to their Street Sweeper Test Protocol.

Verification

This verification was first completed in March 2006 and has been considered valid for subsequent renewal periods every three (3) years thereafter, subject to review and confirmation of the original performance and performance claims.

The original verification was completed by the Prairie Agricultural Machinery Institute (PAMI) of Humboldt, Saskatchewan, using the Canadian ETV Program General Verification Protocol (March 2000). The City of Toronto's test protocol was used for testing a TYMCO Model DST-6 street sweeper at Disco Yard, Toronto, Ontario.

This ETV renewal is considered to meet the equivalency of an ETV verification completed using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on TYMCO Model DST-6 Dustless Regenerative Air Street Sweeper please contact:

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