SIEMENS

Performing material tests

Application examples

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Table of contents

Introduction 1

1.1 Objective

The objective of this application guide is to help the user become familiar with the steps required to:

- perform a material test on a belt scale, flowmeter, or weighfeeder
- calculate a deviation from a material test

1.2 Equipment

Equipment	Article No.
Continuous weighing system	
Secondary verification scale	

1.3 Disclaimer

Note

While every effort is made to verify the following information, no warranty of accuracy or usability is expressed or implied.

How much is your material worth? Information you receive from your continuous weighing device can tell you a lot about what is happening in your plant. The amount of material passing over an instrument is one key piece of information weighing devices provide. This information affects invoicing, production, inventory, waste measurement, material balance, bonus payments, plant efficiency measurements etc. Thus, it is easy to see why scale accuracy is so important.

At the end of an operation year, the tonnage, and most importantly the dollars, lost due to inaccurate measurements can add up to a considerable amount.

JUST ¼% ERROR CAN MAKE A BIG DIFFERENCE						
COST OF MATERIAL LOST BY SCALE INACCURACIES OF ONLY ¼% FOR AN 8 HOUR SHIFT, 5 DAYS A WEEK, FOR 1 YEAR						
COST/TON	**@200 TPH**	**@500 TPH**	**@1,000 TPH**	**@2,000 TPH**	**@5,000 TPH**	**@10,000 TPH**
$10	$10,400	$26,000	$52,000	$104,000	$260,000	$520,000
$20	$20,800	$52,000	$104,000	$208,000	$520,000	$1,040,000
$30	$31,200	$78,000	$156,000	$312,000	$780,000	$1,560,000
$40	$41,600	$104,000	$208,000	$416,000	$1,040,000	$2,080,000
$50	$52,000	$130,000	$260,000	$520,000	$1,300,000	$2,600,000
$60	$62,400	$156,000	$312,000	$624,000	$1,560,000	$3,120,000
$70	$72,800	$182,000	$364,000	$728,000	$1,820,000	$3,640,000
$80	$83,200	$208,000	$416,000	$832,000	$2,080,000	$4,160,000

Overview

2

Performing material tests is the most accurate way to verify the performance of a weighing device, whether it is a belt scale, weighfeeder, flowmeter, or any other continuous weighing instrument.

A material test compares measurements taken by the continuous instrument (belt scale, weighfeeder, flowmeter etc.) to a second scale. The second scale should be a trusted or certified scale to ensure a reliable comparison. Factors such as tare weight from the material container, a change in driver, and fuel amount should be considered as multiple tests may be required at different flow rates. Some material tests can take many hours or days to complete.

Planning/testing 3

3.1 Before Testing

Before performing material tests, ensure that the scale has been commissioned and a record can be found of the last zero and span calibrations to verify repeatability. It is also very important to verify the accuracy of the span calibration. If multiple material tests show a consistent deviation, then a span adjustment can be made. If the material test results are not consistent, there is likely an installation problem. Please verify the items below before performing any further material tests:

- **Idler alignment**: Using the operating instructions as a guide, ensure that the proper number of idlers are aligned before and after the scale idler(s). Scale quality idlers should be used in high accuracy applications.
- **Belt tension**: Belt tension can be checked by measuring sag between idlers. The sag should be greater than 1 % of idler spacing, but should not exceed 2 %.
- **Scale location**: Ensure that the scale is not located close to any transition idlers, curves, pulleys, feed points, training idlers, or sources of vibration.
- **Conveyor structure**: The conveyor structure must be suitable to support the load of the conveyor itself and the material it carries. If deflection in the structure occurs, supporting members must be added.
- **Load cell signal**: When the scale is carrying a normal load on the belt, check the mV output of the cells compared to the dead load. If the difference is less than 3 mV, the load cell capacity may not be suitable.
- **Retention time**: Ensure that belt speed is correct. The minimum time required for material to remain on the scale is 0.25 seconds. If belt speed is too high, retention time may not be sufficient.

3.2 Material Testing

To run a % change material test:

1. Run the belt or pipe empty.
2. Perform a zero calibration.
3. Put the integrator into RUN mode and ensure the totalizer resolution is appropriate.[1]
4. Record the integrator total. This will be the start value.
5. Run material close to the normal flow rate, or at a minimum of 50 % of design rate, over the belt scale, weighfeeder, or flowmeter, for a minimum of 10 minutes.
6. Stop the material feed and run the conveyor or pipe empty.
7. Record the integrator total again. This will be the stop value.
8. Subtract the start value from the stop value to determine the integrator total.

9. Weigh the material sample if not already known.
10. A minimum of three material tests should be done to observe consistency. If tests are not consistent, investigate installation/calibration issues. If material tests are consistent, a correction to the integrator should be made (See Correction factor section below).
11. Perform a final material test with the correction factor in place and verify that the system is within the required accuracy specified.

[1]The desired accuracy must represent at least 2 totalizer counts. For example, if you are using a scale that totalizes in tenths of a ton (0.1 tons per count) and a material sample weighing 1 ton, the integrator will interpret a load of 1.0999 tons as 1 ton until the weight on the belt reaches the next increment of 1.1 tons. In this case, the scale will appear to be very accurate, but, in fact, the error is almost 10 %.

The resolution of the test scale should be similar to that of the conveyor scale. Resolution vs. sample size is an important relationship. A resolution of 0.1 tons in a 1 ton sample size produces an error of 10 %; by comparison the same resolution in a 25 ton sample produces an error of 0.4 %. Generally, as a guide, the resolution should be in thousandths (0.001).

3.3 Span adjustment

Calculate a span adjustment using a Milltronics integrator:

% span adjust = (integrator total – material sample weight) x 100

material sample weight

Note

If the end value is a negative number, enter the adjustment parameter into the integrator.

Enter a span adjustment using a SIWAREX WP241 integrator:

In screen 1.2.3.3, enter the known material mass as the “conveyed amount of material”. Calculate and apply new span digits.

3.4 Correction factor

Calculate a correction factor using a SIWAREX FTC integrator:

Correction factor = material weight of the sample

totalizer of the Siwarex FTC

Ensure that a value between 0.5 and 2 is entered in DR 5 “correction factor”.[2]

[2]If a second correction factor needs to be entered into the SIWAREX FTC, the new value should be multiplied by the original value. For example, if the original correction factor is 0.95 and a new value of 0.9 is calculated, the new correction factor will be 0.855 (0.95 x 0.9).