Definition of Accuracy

Weigh feeder accuracy is a measure of how closely a feeder discharges material at the desired flow rate. A complete expression of accuracy includes measurements of repeatability and linearity. Repeatability measures the extent of discharge variability at a given flow rate. Linearity gauges the deviation of average flow rate over the feeder's full operating range.

Measurements of both repeatability and linearity are made by independently weighing a series of timed catch samples obtained from the discharge stream. Sample weights are then used to compute repeatability and linearity statistics.

Repeatability:

Coperion K-Tron loss-in-weight feeders have been designed to perform to the following repeatability standard:

> ±0.25% to 0.5% of sample average based on a minimum of 30 consecutive samples of one-minute, 0.5kg (~1.0 lb), 0.5% of gross scale capacity, or 30 screw revolutions (30 pump strokes for liquid feeders), whichever is greater, at 2 sigma over a turndown of 20:1 from maximum design rate for free-flowing granular and powdered materials.

Coperion K-Tron weigh belt feeders have been designed to perform to the following repeatability standard:

> ±0.5% of sample average based on a minimum of 30 consecutive samples of one-minute, 0.5kg (~1.0lb) or one belt revolution, whichever is greater, at 2 sigma over a turndown of 20:1 from maximum design rate for free-flowing granular and powdered materials with a minimum belt loading of 0.8kg/m (~0.57lb/ft).

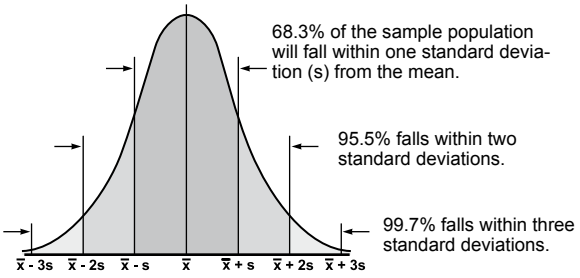
The diversity of materials and their associated handling characteristics require that repeatability performance for a particular combination of feeder and material be determined through laboratory testing.

To quantify the variability of the feeder's discharge stream, the concept of standard deviation is employed. Assuming a random distribution of sample weights around the mean sample weight, the weight of 95.5% of the samples will lie within 2 sigma (standard deviations) from the mean.

Standard deviation, s, is defined as...

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n - 1}}$$

where x_i is sample weight, $\bar{x}$ is average sample weight, and n is the number of samples.



Linearity:

Coperion K-Tron loss-in-weight feeders have been designed to perform to the following linearity standard:

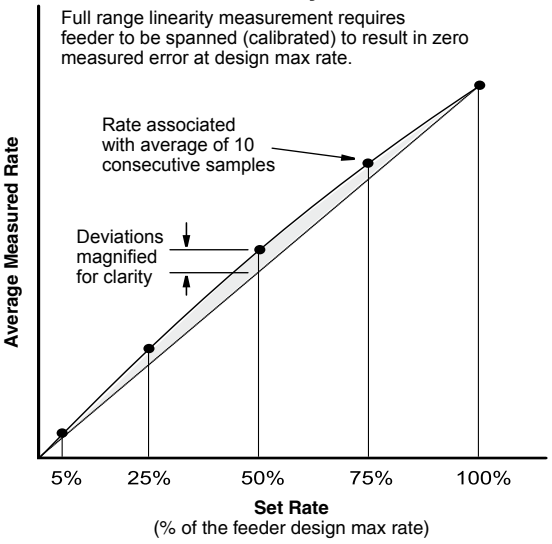
> ±0.25% of set rate based on the mean value of a minimum of 10 consecutive samples of one-minute, 0.5kg (~1.0 lb), 0.5% of gross scale capacity, or 30 screw revolutions (30 pump strokes for liquid feeders), whichever is greater, over a turndown of 20:1 from maximum design rate for free-flowing granular and powdered materials.

Coperion K-Tron weigh belt feeders have been designed to perform to the following linearity standard:

> ±0.5% of set rate based on a minimum of 10 consecutive samples of one-minute, 0.5kg (~1.0lb) or one belt revolution, whichever is greater, over a turndown of 20:1 from maximum design rate for free-flowing granular and powdered materials with a minimum belt loading of 0.8kg/m (~0.57lb/ft).

The diversity of materials and their associated handling characteristics require that linearity performance for a particular combination of feeder and material be determined through laboratory testing.

Linearity



Note that the above definition quantifies linearity performance over the full operating range of the feeder. Many applications involve feeder operation at a constant rate or over a very limited range of rates. In these cases, it is normal practice to re-span (calibrate) the feeder to eliminate or minimize linearity error within the operating range.

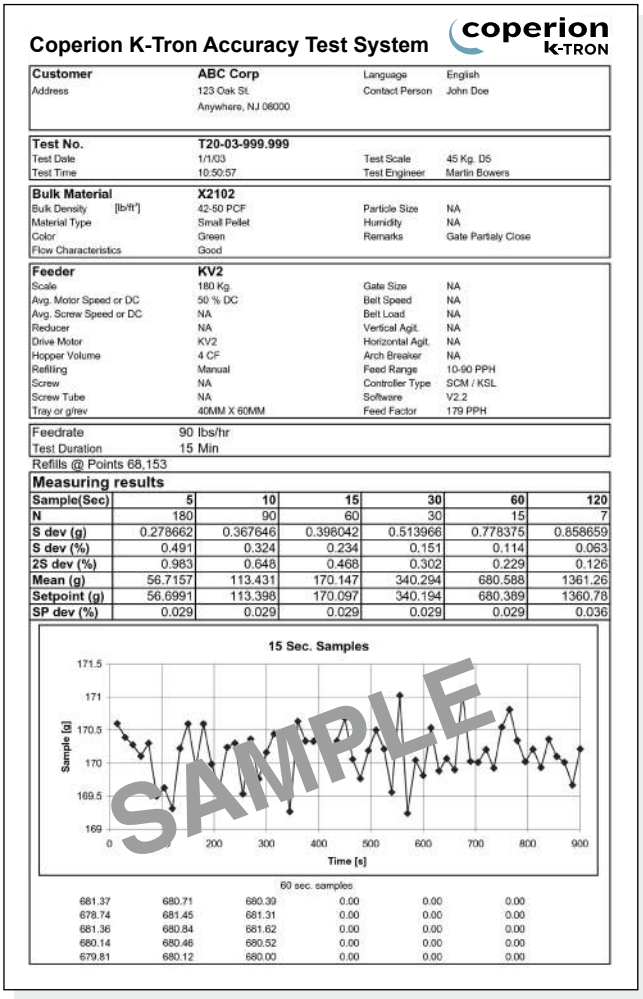
Sampling Procedure:

To most fairly and accurately report the performance of its feeders, Coperion K-Tron employs a sampling procedure called differential dynamic sampling. In this approach, all samples are obtained consecutively and continuously. The feeder under test discharges directly to a sampling container on a high precision electronic scale. Scale readings are automatically communicated to a computer every five seconds (or every second if required by the application). Sample weights for each interval are determined, and all required statistical quantities are computed and presented in a comprehensive, formalized report.

Critical Application Performance Standards (CAPS):

Many demanding applications require feeder performance testing and documentation involving shorter timescales or smaller sample weights than those specified in the standard repeatability statement presented above. For example, high-speed plastics compounding operations must achieve and maintain blend integrity on a nearly second-to-second basis.

Coperion K-Tron offers feeder performance testing for these stringent requirements. Measuring feeder performance at very low rates and/or over very brief timescales permits meaningful evaluation of available feeder components, configurations and settings to identify the one arrangement that optimizes performance for the specific application.



Coperion K-Tron Accuracy Test System

Customer	**ABC Corp**	Language	English
Address	123 Oak St. Anywhere, NJ 08000	Contact Person	John Doe
Test No.	**T20-03-999.999**		
Test Date	1/1/03	Test Scale	45 Kg. DS
Test Time	10:50:57	Test Engineer	Martin Bowers
Bulk Material	**X2102**		
Bulk Density [lb/ft³]	42-50 PCF	Particle Size	NA
Material Type	Small Pellet	Humidity	NA
Color	Green	Remarks	Gate Partialy Close
Flow Characteristics	Good		
Feeder	**KV2**		
Scale	180 Kg.	Gate Size	NA
Avg. Motor Speed or DC	50 % DC	Belt Speed	NA
Avg. Screw Speed or DC	NA	Belt Load	NA
Reducer	NA	Vertical Agit.	NA
Drive Motor	KV2	Horizontal Agit.	NA
Hopper Volume	4 CF	Arch Breaker	NA
Refilling	Manual	Feed Range	10-90 PPH
Screw	NA	Controller Type	SCM / KSL
Screw Tube	NA	Software	V2.2
Tray or g/rev	40MM X 60MM	Feed Factor	179 PPH

Feedrate 90 lbs/hr
Test Duration 15 Min
Refills @ Points 68,153

Measuring results

Sample(Sec)	5	10	15	30	60	120
N	180	90	60	30	15	7
S dev (g)	0.278662	0.367646	0.398042	0.513966	0.778375	0.858659
S dev (%)	0.491	0.324	0.234	0.151	0.114	0.063
2S dev (%)	0.983	0.648	0.468	0.302	0.229	0.126
Mean (g)	56.7157	113.431	170.147	340.294	680.588	1361.26
Setpoint (g)	56.6991	113.396	170.097	340.194	680.389	1360.78
SP dev (%)	0.029	0.029	0.029	0.029	0.029	0.036

60 sec. samples

681.37	680.71	680.39	0.00	0.00	0.00
678.74	681.45	681.31	0.00	0.00	0.00
681.36	680.84	681.62	0.00	0.00	0.00
680.14	680.46	680.52	0.00	0.00	0.00
679.81	680.12	680.00	0.00	0.00	0.00

Coperion K-Tron Test Lab Report

CAPS Feeder Testing Protocols