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Original Research Article

Effect of Weight Stabilization before Curing of V-Belt

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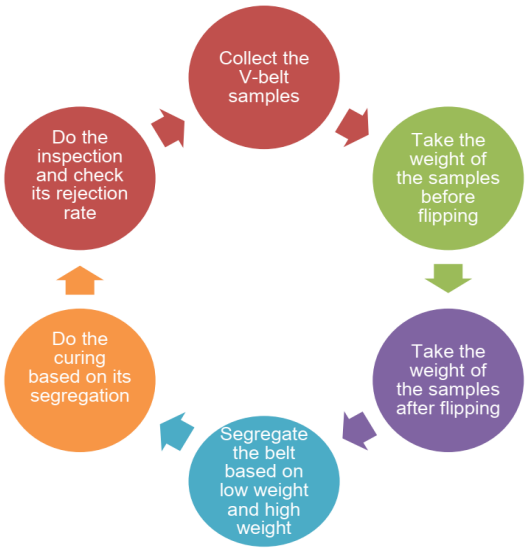
Abstract

Graphical Abstract



The aim of this method is to reduce the rejection rate in V-belt using weight stabilization method. Low Belt, Double Jacket, Topping Air, and Base Air are the major rejection in V-belt due to the dissimilar weight in V-belt as the weight plays a vital role in determining the quality of a product and processing parameter such as pressure and heat. The above problems can be rectified by taking weight during the final processing stage of V-belt subsequently it can be segregated depending upon the weight range before curing and then set the curing parameters. Another aspect of taking correct weight every time for the same length & cross section of belt is the regularity of dimension. I vehemently envisage that this method can be used to reduce the rejection rate based on dissimilar weight for any rubber based products not only the V-belt. The benefits of this method is extended below

- Sophisticated device are not required to implement this method.
- Products having uneven weight can be converted into defect free product.
- Rejection rate can be firmly controlled.

Keywords: V-belt; Weigh; Stabilization; Curing.

METHOD

Fish bone diagram as shown in the figure 1 has been used as a preliminary tool [1] to find out the various causes for dissimilar weight in V-belt which leads to higher rejection rate by dint of insufficient quality and in order to reduce this rejection rate a new method has been established to stabilize the weight as mentioned below in the following steps.

Equipment

- Weighing machine
- Horizontal roto curing drum
- Vernier caliper

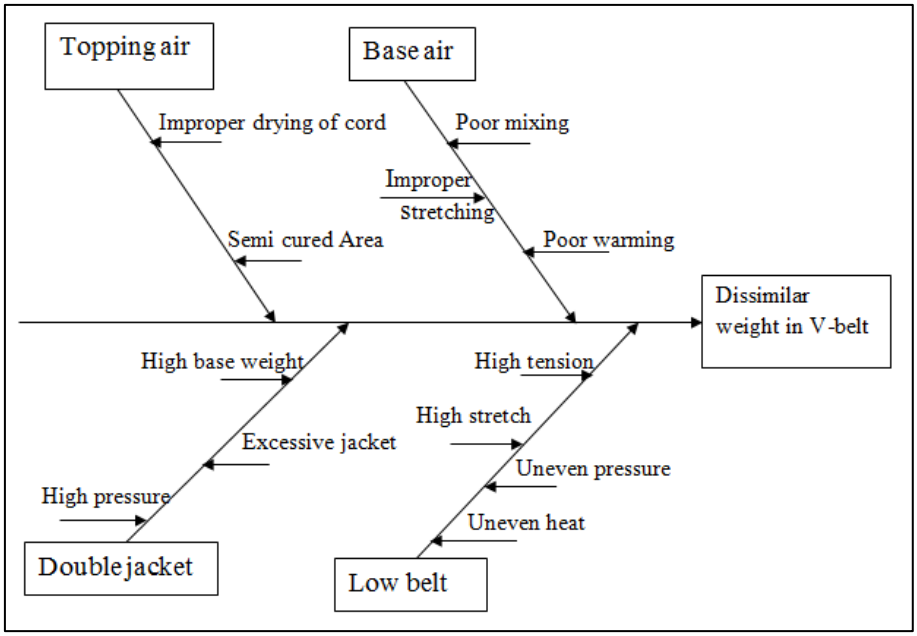


Fig-1: Fish bone diagram

Record the weight of V-belt

Take the weight of raw belt before flipping as well as after flipping as it is a process of wrapping the raw belt for further defending the internal composition of V-belt. There after take the weight after the curing process in terms of gram per inch for the cluster of V-belt.

Segregate the V-belt

Segregate the belt for its next curing stage according to the maximum and minimum value of weight and then set the tolerance value.

Curing

Set the temperature & pressure in a horizontal roto curing drum according to its specification and weight range as higher pressure is needed to apply for low weight belt and lower pressure for belt having more weight.

Inspection

After completion of curing and cooling process, measure the dimension of cured V-belt with the help of Vernier caliper and inspect the quality of V-belt to separate the defect products.

When over viewing and going through the various studies conducted, it has been observed that the rejection rate was reduced from 0.6% to 0.3% by avoiding Base Air, Topping Air, Double Jacket, and nearly zero rejection in Low belt through this weight stabilization method together with the production feasibility as shown in the figure 2.

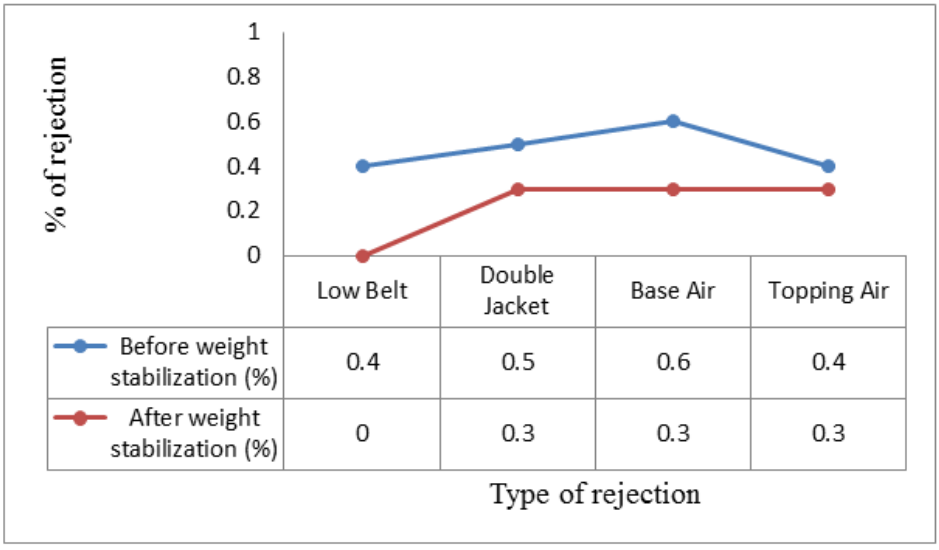


Fig-2: Comparison of rejection rate before and after stabilizing the weight

Method Validation

In order to validate this method, 15 batches of V-belt have been taken into an account as presented below.

Batch-1:

Segregation of belt : +30 gram & -30 gram

Pressure between drum & wire pad

For +30 : 700 psi
For -30 : 730 psi
Drum rotation : 660 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	5.565	5.681	5.451	0.231
After flipping (g)	7.391	7.505	7.253	0.253
After curing (g)	334.0	0.36	0.304	0.056

Result:

Total : 17
Ok : 17
Rejection : nil
Reason : proper pressure has been given to this batch according to the weight.

Batch-2:

Segregation of belt : +70 gram & -70 gram

Pressure between drum & wire pad

For +70 :700 psi
For -70 :740 psi
Drum rotation : 660 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	6.159	6.363	5.887	0.476
After flipping(g)	7.922	8.218	7.613	0.605
After curing (g)	433.75	546	318	228

Result:

Total : 17
Ok : 17
Rejection : nil
Reason : proper pressure has been given to this batch according to the weight.

Batch-3:

Segregation of belt : +40 gram & -40 gram

Pressure between drum & wire pad

For +40 : 560 psi
For –40 : 590 psi
Drum rotation : 540 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	12.329	12.486	12.125	0.361
After flipping(g)	15.51	15.764	15.208	0.556
After curing (g)	408.154	482	230	252

Result:

Total : 10
Ok : 10
Rejection : nil
Reason : proper pressure has been given to this batch according to the weight.

Batch-4:

There is no need to segregate the belt, since all the belts are within the range of 40gram.
Pressure between drum & wire pad : 730 psi
Drum rotation : 660 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	3.367	3.461	3.199	0.262
After flipping(g)	4.508	4.615	4.411	0.204
After curing (g)	235.765	272	214	58

Result:

Total : 23
Ok : 23
Rejection : nil
Reason : All the belts are within the range of 40gram.

Batch-5:

There is no need to segregate the belt, since all the belts are within the range of 40 gram.
Pressure between drum & wire pad : 570 psi
Drum rotation : 450 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	32.469	33.027	31.912	1.115
After flipping(g)	38.543	38.959	37.91	1.048
After curing (g)	544.714	584	472	112

Result:
Total : 14
Ok : 14
Rejection : nil
Reason : All the belts are within the range of 40gram.

Batch-6:
Segregation of belt : +50 gram & -50 gram

Pressure between drum & wire pad
For +50 : 550 psi
For –50 : 600 psi
Drum rotation : 600 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	7.186	7.387	6.864	0.523
After flipping(g)	9.195	9.405	9.013	0.392
After curing (g)	491.765	542	420	122

Result:
Total : 17
Ok : 16
Rejection : (1) Jacket opening
Reason : Improper Flipping

Batch-7:
Segregation of belt : +70 gram & -70 gram
Pressure between drum & wire pad
For +70 : 560
For -70 : 600
Drum rotation : 450 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	31.826	32.627	31.03	1.597
After flipping(g)	38.14	38.825	37.354	1.471
After curing (g)	601.143	678	522	156

Result:
Total : 14
Ok : 14
Rejection : nil
Reason : proper pressure has been given to this batch according to the weight.

Batch-8:
Segregation of belt : +60 gram & -60 gram

Pressure between drum & wire pad
For +60 : 550 psi
For -60 : 590 psi
Drum rotation : 450 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	30.897	31.43	29.518	1.912
After flipping(g)	37.016	37.459	36.157	1.303
After curing (g)	582.571	696	450	246

Result:
Total : 14
Ok : 13
Rejection : (1) Base air
Reason : Due to Improper Warming in the two roll mill.

Batch-9:
There is no need to segregate the belt, since all the belts are within the range of 30g.
Pressure between drum & wire pad : 725 psi
Drum rotation : 660 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	5.766	5.831	5.685	0.146
After flipping(g)	7.626	7.708	7.528	0.18
After curing (g)	331.125	352	316	36

Result:
Total : 17
Ok : 17
Rejection : nil
Reason : All the belts are within the range of 30gram.

Batch-10:
Segregation of belt : +55 gram & -55 gram

Pressure between drum & wire pad
For +55 : 550 psi
For -55 : 580 psi
Drum rotation : 600 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	6.96	7.077	6.746	0.331
After flipping(g)	8.778	8.999	8.441	0.558
After curing (g)	351.882	408	290	118

Result:
Total : 17
Ok : 16
Rejection : (1) Flipping mistake
Reason : Improper Flipping

Batch-11:
There is no need to segregate the belt, since all the belts are within the range of 30gram.

Pressure between drum & wire pad: 720 psi
Drum rotation : 660 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	5.754	5.824	5.59	0.234
After flipping(g)	7.379	7.454	7.268	0.185
After curing (g)	333.125	364	298	66

Result:
Total : 17
Ok : 16
Rejection : (1) Band touch
Reason : Teared Fibre cloth is used during the curing period.

Batch-12
There is no need to segregate the belt, since all the belts are within the range of 40gram.
Pressure between drum & wire pad : 720 psi
Drum rotation : 660 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	5.734	5.845	5.555	0.291
After flipping(g)	5.949	6.045	5.864	0.182
After curing (g)	48.133	80	18	62

Result:
Total : 16
Ok : 15
Rejection : (1) Band touch
Reason : Teared Fibre cloth is used during the curing period.

Batch-13
There is no need to segregate the belt, since all the belts are within the range of 30gram.
Pressure between drum & wire pad : 720 psi
Drum rotation : 660 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	5.357	5.52	5.076	0.444
After flipping(g)	7.525	7.591	7.467	0.124
After curing (g)	487.882	542	460	82

Result:
Total : 17
Ok : 17
Rejection : nil
Reason : All the belts are within the range of 30gram & proper pressure is given.

Batch-14:
Segregation of belt : +75 gram & -75 gram

Pressure between drum & wire pad
For +75 : 700 psi
For -75 :740 psi
Drum rotation : 600 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	7.051	7.335	6.733	0.603
After flipping(g)	8.961	9.178	8.644	0.534
After curing (g)	557.765	622	424	198

Result:
Total : 17
Ok : 16
Rejection : (1) Double Jacket
Reason : High Pressure

Batch-15:
Segregation of belt : +60 gram & -60 gram

Pressure between drum & wire pad
For +60 :720 psi
For -60 :750 psi
Drum rotation : 540 rpm

Dimension	Average	Maximum	Minimum	Range
Before flipping (g)	12.814	12.995	12.462	0.533
After flipping(g)	15.473	15.703	15.077	0.626
After curing (g)	476.214	622	308	314

Result:
Total : 11
Ok : 11
Rejection : nil
Reason : proper pressure is given to this batch according to the weight.

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1. Praveen, P. J., & Senthil, A. B. (2005). Total Quality Management, Scitech publications (India) PVT. LTD.